



PROJECT MANUAL

for:

NILAND PUBLIC SAFETY FACILITY PROJECT

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Holt Architecture

for



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SECTION 03 10 00

CONCRETE FORMWORK AND ACCESSORIES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Design, furnish and install forms for concrete as indicated on drawings and specified here. Remove forms and shores at specified time. Clean up.
- B. Related Work
 - 1. Reinforcing Steel: Section 03 21 00.
 - 2. Cast-In-Place Concrete: Section 03 30 00.
 - 3. Structural Steel: Section 05 12 00.
 - 4. Metal Fabrications: Section 05 50 00.
 - 5. Rough Carpentry: Section 06 10 00.
 - 6. Items relating solely to mechanical or electrical work are included under those Divisions, except as specifically indicated otherwise on Drawings.

1.03 STANDARDS AND REFERENCES

- A. 2016 California Building Code (CBC).
- B. American Concrete Institute (ACI).
 - 1. ACI 303R "Guide to Cast-In-Place Architectural Concrete Practice"
 - 2. ACI 318 "Building Code Requirements for Structural Concrete"
 - 3. ACI 347 "Recommended Practice for Concrete Formwork"
- C. Standard Grading and Dressing Rules #17, West Coast Lumber Inspection Bureau (For Douglas Fir Form Lumber).
- D. U.S. Product Standard PS 1 (For Plywood Form Lumber).

1.04 QUALITY ASSURANCE

- A. General:
 - 1. Conform to all requirements of ACI 347 and ACI 318 Section 6.1 and 6.2.
 - 2. Concrete formwork shall be designed and constructed to safely support fluid concrete and superimposed construction loads without excessive deflection or concrete leakage. Provide bracing to maintain accurate alignment and to resist all anticipated lateral loads. Forms shall conform with drawings as to shape, line, and dimension. Design, engineering and construction of forms shall be Contractor's responsibility. Formwork for exposed concrete shall be constructed to tolerances indicated in ACI 303R.
 - 3. Cooperate and coordinate with other trades who furnish and/or install piping, conduit, reglets, anchors, inserts, sleeves, hangers, etc., as their work requires; including provisions for recesses and chases.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- C. Submittals:
 - 1. Product Data. Provide manufacturers data and installation instructions for the following:
 - a. Tie rods and spreaders
 - b. Formwork for exposed concrete.
 - c. Form coating and release agents.

1.07 DELIVERY, STORAGE AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

- 2.01 MATERIALS
 - A. Form Material:
 - 1. Smooth Concrete exposed to view: 5/8 inch minimum APA Plyform or steel.
 - 2. Concrete concealed from view: 5/8 inch minimum APA Plyform, steel or clean and sound 1 x 8 Standard Grade Douglas Fir.

- B. Fiber Forms: Tubular column forms spirally constructed of laminated plies of fiber. Plies shall be laminated using a non-water sensitive adhesive and surface wax impregnated for moisture protection. Forms shall give a smooth and seamless appearance to the cast concrete. Provide reveals, as shown on the drawings, as supplied by the form manufacturer. Forms shall be as manufactured by Sonoco Products, plastic lined; Burke Smoothtube by Burke Co.; or approved equal.
- C. Form Clamps: Assembly to have cone washers, (1 inch break back) 3/8" inch center rod.
- D. Form Ties:
 - 1. Concrete exposed to view: Snap ties allowing full 1 inch break back.
 - 2. Concrete concealed from view: Snap ties or wire.
 - 3. Verify special spacing requirements with architectural drawings at exposed concrete.
- E. Spreaders: Metal (no wood).
- F. Form Coating: Non-grain and non-staining types of form coating that will not leave a residual matter on the face of the concrete or adversely affect proper bonding of any subsequent paint or other surface applications.
 - 1. Form coating containing mineral oils or other non-drying materials will not be permitted for any concrete work.
- G. Joint Tape: No. 471 plastic film tape 3 inches wide, as manufactured by the Industrial Tape Division of 3M Company.
- H. Expansion Joint Filler (Preformed): ½ inch thick; Flexcell by Celotex Corporation, Elastic Fiber Expansion Joint by Phillip Carey Mfg. Co., or Sealtight Fiber Expansion Joint by W.R. Meadows, Inc.
- I. Extruded Polystyrene Foam: ASTM C578 type IV. Dow Chemical Corp. "Styrofoam", UC Industries "Foamular", or approved equal.

PART 3 - EXECUTION

3.01 FORM CONSTRUCTION

- A. Construct substantial forms to the shapes, lines, grades and elevations shown, sufficiently tight to prevent leakage of mortar, and tied, clamped and braced to prevent spreading, shifting or settling. Plywood joints shall be square and tight; plywood shall be arranged in such manner as to minimize number of joints and to provide a smooth, attractive finished concrete surface.
- B. Apply form coating to forms before reinforcing steel is in place.
- C. Sleeves, anchors and bolts, including those for angle frames, supports, ties and other materials in connection with concrete construction, shall be secured in position before the concrete is placed.
- D. Proper provisions shall be made for openings, blockouts, sleeves, offsets, sinkages, recesses and depressions required by other trades and suppliers prior to placing concrete.
 - 1. The Contractor shall also see that sleeves have been installed and other provisions have been made for the installation of mechanical, electrical and other equipment.
 - 2. Coordinate with all trades to insure proper placement of all items in forms and to provide proper blockouts wherever required.
- E. Concrete work out of alignment, level or plumb will be cause for rejection of the whole work affected and, if so rejected, such work shall be removed and replaced, as directed by Architect, with no additional cost to the Owner.
- F. Form Not Required: Concrete footings may be poured directly against cut earth where feasible

and when the Architect's approval has been obtained.

- 1. See structural drawings for requirements for placing concrete footings directly against earth without forms.
- G. Use ³/₄ inch minimum wood chamfer strips typical at all exposed corners unless noted otherwise on drawings.

3.02 CLEANING OF FORMS

- A. All dirt, chips, sawdust, rubbish, water, etc. shall be completely removed from form by water hosing and air pressure before any concrete is deposited therein. No wooden ties or blocking shall be left in concrete except where indicated for attachment of other work.
- B. Thoroughly clean and patch all holes in formwork and re-coat as required before reusing. Forms not suited to obtain concrete surfaces and tolerances in conformity with Contract requirements will be rejected by Architect.
 - 1. Reuse of forming materials shall be limited only as required to produce the finishes as specified, free from blemishes and other defects unless covered by other building materials in which case blemish free concrete is not required.

3.03 INSPECTION OF FORMS

A. Notify the Architect at least 48 hours in advance of the beginning of pouring operations and at the completion of formwork and location of all construction joints. An inspection of forms and joints will be made for approval of finished work and general layout only. The foregoing inspection shall in no way relieve the Contractor of responsibility of design and safety or formwork, bulkheads and shorings.

3.04 REMOVAL OF FORMS AND SHORING

- A. Do not remove forms until concrete has attained sufficient strength to support its weight and any construction loading. Concrete must be allowed to cure long enough to avoid damage during form removal. Contractor or his representative in charge of concrete construction shall be present during removal of forms and shores, and shall be personally responsible for safety of this operation at all times and under all conditions.
- B. As a minimum, formwork and shoring shall remain in place for the following periods:
 - 1. Concrete on grade: 24 hours
 - 2. Walls and Columns: 3 days
 - 3. Formwork may be removed and reshores installed before the times indicated above, provided the concrete has cured sufficiently to avoid damage when formwork is removed. Shores must be immediately replaced with reshores in a sequence designed to avoid inducing stress in the concrete member.

3.05 ADJUSTING AND CLEANING

- A. Upon completion of this Work, clean up and remove from Site all equipment and debris resulting from this work.
- B. Surfaces to be painted shall be smooth and free of substances such as dirt, wax, excessive latence, grease or materials that would prevent proper bonding of finishes.
 - 1. Removal of foregoing contaminants, and complete removal of parting and curing compounds affecting proper paint bond, shall be responsibility of this Section of Work. Sandblast cleaning shall not be employed without specific approval of Structural Engineer.

END OF SECTION

SECTION 03 21 00 REINFORCING STEEL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Unless noted otherwise, furnish and install reinforcing for all concrete, including dowels, chairs, spacers, bolsters, etc., necessary for supporting and fastening reinforcement in place as shown on the Drawings and specified herein.

1.03 STANDARDS AND REFERENCES

- A. 2016 California Building Code (CBC).
- B. American Concrete Institute (ACI).
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings".
 - 2. ACI 315 "Details and Detailing of Concrete Reinforcing".
 - 3. ACI 318 "Building Code Requirements for Structural Concrete"
- C. American Society for Testing and Materials (ASTM).
 - 1. ASTM A82 "Cold Drawn Wire for Concrete Reinforcement".
 - 2. ASTM A185 "Welded Steel Wire Fabric for Concrete Reinforcement".
 - 3. ASTM A615 "Deformed and Plain Billet-Steel Bars for Concrete Reinforcement".
 - 4. ASTM A706 "Low Alloy Steel Deformed Bars for Concrete Reinforcement".
- D. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice".
- E. American Welding Standard (AWS): AWS D1.4 "Structural Welding Code Reinforcing Steel".

1.04 QUALITY ASSURANCE

- A. General:
 - 1. Acceptable Manufacturers: Regularly engaged in the manufacture of steel bar and welded wire fabric reinforcing.
 - 2. Installer Qualifications: Installation shall be done only by an installation firm normally engaged in this business. All work shall be performed by qualified mechanics working under an experienced supervisor.
 - 3. Welding Qualifications: Welding procedures, welding operators and welders shall be qualified in accordance with AWS D1.4 "Structural Welding Code Reinforcing Steel".
 - a. Welders whose work fails to pass inspection shall be re-qualified before performing further welding.
 - 4. Reinforcement Work shall conform to ACI 301 and ACI 318 Chapter 25, as minimum standards.
 - 5. Allowable Tolerances:

- a. Fabrication:
 - i. Sheared length: 1 inch.
 - ii. Depth of truss bars: Plus or minus ¹/₂-inch.
 - iii. Ties: Plus or minus ¹/₂-inch.
 - iv. All other bends: Plus or minus 1 inch.
- b. Placement:
 - i. Concrete cover to form surfaces: Plus or minus 1/4-inch.
 - ii. Minimum spacing between bars: Plus or minus ¼-inch.
 - iii. Crosswise of members: Spaced evenly within 2 inches of stated separation.
 - iv. Lengthwise of members: Plus or minus 2 inches.
- c. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 2 bar diameters.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- C. Submittals:
 - 1. Shop Drawings: Prepare in accordance ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars and shapes, dimensions and details of bar reinforcing and assemblies. Correctness of all reinforcing requirements and work is the responsibility of Contractor. Identify such shop drawings with reference thereon to sheet and detail numbers from Contract Drawings.
 - i. Do not use scaled dimensions from Contract Drawings in determining the lengths of reinforcing bars.
 - ii. No reinforcing steel shall be fabricated without approved shop drawings.
 - iii. Any deviations from the contract documents must be clearly indicated as a deviation on the shop drawings.
 - iv. Areas of high congestion, including member joints and embed locations shall be fully detailed to verify clearances and assembly parameters and coordination with other trades.
 - 2. Certified mill test reports of supplied reinforcing indicating chemical and physical analysis. Tensile and bend tests shall be performed by the mill in accordance with ASTM A615.
 - 3. Product Data:
 - i. Manufacturer's specifications and installation instructions for splice devices.

- ii. Bar Supports.
- 4. Certificates of Compliance with specified standards:
 - i. Reinforcing bars.
 - ii. Welded wire fabric.
 - iii. Welding electrodes.
- 5. Samples: Only as requested by Architect.
- D. Tests and Inspections:
 - 1. A testing program is required prior to start of construction. Testing program to be done in compliance with the CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.
 - 2. All reinforcing steel whose properties are not identifiable by mill test reports shall be tested in accordance with ASTM A615. One Series of tests for each missing report to be borne by the Contractor.
 - 3. When inspections are indicated for reinforcement placement on the Structural drawings, a special inspector shall be employed to inspect reinforcing placement per CBC Section 1704.
 - 4. When tests are indicated for reinforcing steel on the structural drawings, the reinforcing steel used shall be tested in accordance with ASTM A615. One tensile and one bend test for each 2-1/2 tons of steel or fraction thereof, shall be made.
 - 5. Inspect shop and field welding in accordance with AWS D1.4, including checking materials, equipment, procedure and welder qualification as well as the welds. Inspector will use non-destructive testing or any other aid to visual inspection that he deems necessary to assure himself of the adequacy of the weld.
 - 6. Tests and inspection shall be performed by Owners testing agency except when needed to justify rejected work, in which case the cost of retests and reinspection shall be borne by the Contractor.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.
- D. Handle and store materials to prevent contamination.
 - 1. Store reinforcement in a manner that will prevent excessive rusting or coating with grease, oil, dirt, and other objectionable materials. Storage shall be in separate piles or racks so as to avoid confusion or loss of identification after bundles are broken.
- E. Deliver and store welding electrodes in accordance with AWS D1.4.

1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Reinforcement Bars: ASTM A615, Grade 60 for all bars.
 - 1. Bar reinforcement to be welded shall meet chemical requirements of ASTM A706.
 - 2. Longitudinal reinforcement in column and beams of special moment-resisting frames shall meet the chemical requirements of ASTM A706.
- B. Stirrups and Ties: ASTM A615, Grade 60 for all bars.
- C. Steel Dowels: Same grade as bars to which dowels are connected.
- D. Welded wire Fabric: ASTM A185.
- E. Tie Wires: FS-QQ-W-461, annealed steel, black, 16 gauge minimum.
- F. Welding Electrodes: AWS D1.4, low hydrogen, E70XX series.
- G. Bar Supports:
 - 1. Typical, unless noted otherwise; CRSI Class 2 wire supports.
 - i. Do not use wood, brick or other objectionable materials.
 - ii. Do not use galvanized supports.
 - 2. Supports placed against ground: Pre-cast concrete blocks not less than 4 inches square with embedded wire.
- H. Mechanical Couplers: Comply with ACI 318 section 25.5.7.1

PART 3 - EXECUTION

- 3.01 FABRICATION
 - A. Shop fabricate reinforcement to meet requirements of Drawings.
 - B. Fabricate reinforcement in accordance with the requirements of ACI 315 where specific details are not shown or where Drawings and Specifications are not more demanding.
 - C. Steel reinforcement shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the Drawings shall not be used. Heating of bars for bending will not be permitted.
 - D. Reinforcing shall not be field bent or straightened without structural engineer's review.
 - E. Provide offsets in rebar (1:6 maximum) where required to maintain clearances.

3.02 CONDITION OF SURFACES

A. Examine surfaces and conditions receiving or affecting the work. Do not proceed until unsuitable conditions have been corrected.

3.03 <u>GENERAL</u>

A. Concrete shown without reinforcing shall be reinforced as similar parts shown with reinforcing except where concrete is specifically noted to be unreinforced.

3.04 PLACEMENT

- A. All reinforcement shall be accurately set in place, lapped, spliced, spaced rigidly and securely held in place and tied with specified wire at all splices and crossing points. All wire tie ends shall point away from the form. Carefully locate all dowel steel to align with wall and column steel.
 - 1. Bars shall be in long lengths with laps and splices as shown. Offset laps in adjacent bars. Place steel with clearances and cover as shown. Bar laps shall be as indicated on the Drawings. Tie all laps and intersections with the specified wire.
 - 2. Maintain clear space between parallel bars not less than 1-1/2 times nominal diameter, but in no case shall clear space be less than 1-1/2 times maximum size concrete aggregate.
 - 3. Reinforcing dowels for slabs shall be placed as detailed. Sleeves may be used if reviewed by the Structural Engineer before installation. Install dowel through all construction and expansion joints for all slabs on grade.
- B. Bar Supports: Support and securely fasten bars with chairs, spacers and ties to prevent displacement by construction loads or placement of concrete beyond the tolerances specified. Conform to CRSI as a minimum standard.
- C. Steel Adjustment:
 - 1. Move within allowable tolerances to avoid interference with other reinforcing steel, conduits, or embedded items.
 - 2. Do not move bars beyond allowable without concurrence of Structural Engineer.
 - 3. Do not heat, bend, or cut bars without concurrence of Structural Engineer.
 - 4. Reinforcement shall not be bent after being embedded in hardened concrete.
- D. Splices:
 - 1. Splice reinforcing as shown.
 - 2. Lap Splices: Tie securely with wire to prevent displacement of splices during placement of concrete.
 - 3. Splice Devices: Install in accordance with manufacturer's written instructions. Obtain Structural Engineer's review before using.
 - 4. Do not splice bars except at locations shown without concurrence of Structural Engineer.
 - i. Where splices in addition to those indicated are required, indicate location on shop drawings clearly and highlight "for Engineer's approval".
- E. Welding:
 - 1. Welding is not permitted unless specifically detailed on Drawings or approved by Engineer.
 - 2. Employ shielding metal-arc method and meet requirements of AWS D1.4.
 - 3. Welding is not permitted on bars where the carbon equivalent is unknown or is determined to exceed 0.55.

- 4. Welding shall not be done within two bar diameters of any bent portion of a bar which has been bent cold.
- 5. Welding of crossing bars is not permitted.
- F. Welded Wire Fabric: Install in long lengths, lapping 24 inches at end splices and one mesh at side splices. Offset laps in adjacent widths. Place fabric in approximately the middle of the slab thickness unless shown otherwise on the Drawings by dimension. Wire tie lap joints at 12-inch centers. Use concrete blocks to support mesh in proper position.
- G. Reinforcement shall be free of mud, oil or other materials that may reduce bond at the time concrete is placed. Reinforcement with tightly adhered rust or mill scale will be accepted without cleaning provided that rusting has not reduced dimensions and weights below applicable standards. Remove loose rust.
- H. Protection against rust:
 - 1. Where there is danger of rust staining adjacent surfaces, wrap reinforcement with impervious tape or otherwise prevent rust staining.
 - 2. Remove protective materials and clean reinforcement as required before proceeding with concrete placement.
- I. Drawing Notes: Refer to notes on Drawings for additional reinforcement requirements.
- J. Mechanical and Electrical Drawings: Refer to Mechanical and Electrical Drawings for formed concrete requiring reinforcing steel. All such steel shall be included under the work of this Section.

END OF SECTION

SECTION 03 24 00

FIBROUS REINFORCING

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all fibrous reinforcing, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete and proper installation.
- B. Section includes, but is not limited to:
 - 1. Polypropylene fibers used as concrete secondary reinforcement.
- C. Related Sections:
 - 1. Section 03 20 00 Reinforcing Steel.
 - 2. Section 03 30 00 Cast-in-Place Concrete.

1.03 STANDARDS AND REFERENCES

- A. ASTM C 94 Standard Specification for Ready-Mixed Concrete.
- B. ASTM C 1116 Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
- C. Southwest Certification Services (SWCS), Omega Point Laboratories No. 8662-1.
- D. UL Report File No. R8534-11.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Synthetic fiber reinforcement manufactured in ISO 9001:2000 certified facility.
 - 2. Minimum 10-year satisfactory performance history of specified synthetic fiber reinforcement.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Product Data: Submit manufacturer's product data, including application rate and mixing instructions.
- D. Samples: Submit manufacturer's sample of synthetic fiber reinforcement.

- E. Manufacturer's Certification:
 - 1. Submit manufacturer's certification that synthetic fiber reinforcement complies with specified requirements.
 - 2. Submit evidence of manufacturer's ISO 9001:2000 certification.
 - 3. Submit evidence of satisfactory performance history of synthetic fiber reinforcement.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03B Services, Materials and Equipment.
- C. Delivery: Deliver synthetic fiber reinforcement in manufacturer's original, unopened, undamaged containers and packaging, with labels clearly identifying product name, unique identification number, code approvals, directions for use, manufacturer, and weight of fibers.
- D. Storage:
 - 1. Store synthetic fiber reinforcement in clean, dry area indoors in accordance with manufacturer's instructions.
 - 2. Keep packaging sealed until ready for use.
- E. Handling: Protect synthetic fiber reinforcement during handling to prevent contamination.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.9 EXTRA MATERIALS

Provide in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 <u>MANUFACTURER</u>

- A. Basis of Design: Propex Operating Company, LLC, PO Box 22788, Chattanooga, TN 37422. Toll Free (800) 621-1273. Website: www.fibermesh.com
- B. Or Architect approved equal.

2.02 SYNTHETIC FIBER REINFORCEMENT

- A. Synthetic Fiber Reinforcement: Fibermesh 300.
 - 1. Material: 100 percent virgin homopolymer polypropylene multifilament fibers, containing no reprocessed olefin materials.
 - 2. Conformance: ASTM C 1116, Type III.
 - 3. Fire Classifications:
 - i. UL Report File No. R8534-11.
 - ii. Southwest Certification Services (SWCS), Omega Point Laboratories No. 8662-1.
 - 4. Fiber Length: Graded and Single-cut lengths.
 - 5. Alkali Resistance: Alkali proof.
 - 6. Absorption: Nil.
 - 7. Specific Gravity: 0.91.
 - 8. Melt Point: 324 degrees F (162 degrees C).

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Notify the Construction Manager and Architect in writing of any conditions detrimental to the proper and timely completion of the installation.
- C. Correct conditions detrimental to timely and proper complete of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 <u>MIXING</u>

- A. Add synthetic fiber reinforcement to concrete mixture in accordance with manufacturer's instructions.
- B. Add synthetic fiber reinforcement into concrete mixer before, during, or after batching other concrete materials.
- C. Application Rate: Add synthetic fiber reinforcement at standard application rate of 1.5 pounds per cubic yard (0.90 kg/m³) of concrete.
- D. Mix synthetic fiber reinforcement in concrete mixer in accordance with mixing time and speed of ASTM C 94 to ensure uniform distribution and random orientation of fibers throughout concrete.
- E. Concrete shall be as specified in Section 03 30 00.

3.03 PLACING AND FINISHING

Placing and finishing concrete shall be as specified in Section 03 30 00.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Furnish, place and finish cast in place concrete and related work as indicated on the Drawings and specified here.
 - 1. Install miscellaneous metal and other items furnished by other trades to be installed in concrete work.
 - 2. Provide facilities for job curing of test cylinders and transporting to Testing Laboratory.
- B. Provide grouting of steel base plates as indicated on the Drawings and specified here.
- C. Related Work
 - 1. Concrete Formwork: Section 03 10 00.
 - 2. Reinforcing Steel: Section 03 21 00.
 - 3. Structural Steel: Section 05 12 00.
 - 4. Metal Fabrications: Section 05 50 00.

1.03 STANDARDS AND REFERENCES

- A. Standards and References: (Latest Edition unless otherwise noted)
 - 1. 2016 California Building Code (CBC).
 - 2. American Concrete Institute (ACI)
 - i. ACI 117 "Standard Tolerances for Concrete Construction and Materials"
 - ii. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete"
 - iii. ACI 211.2 "Standard Practice for Selecting Proportions for Structural Lightweight Concrete"
 - iv. ACI 301 "Structural Concrete for Buildings"
 - v. ACI 302 "Guide for Concrete Floor and Slab Construction"
 - vi. ACI 305R "Hot Weather Concreting"
 - vii. ACI 306R "Cold Weather Concreting"
 - viii. ACI 318 "Building Code Requirements for Structural Concrete"
 - ix. ACI 360 "Design of Slabs-On-Ground"
 - 3. American Society for Testing and Materials (ASTM)
 - i. ASTM C31 "Making and Curing Concrete Test Specimens in the Field"
 - ii. ASTM C33 "Concrete Aggregates"

- iii. ASTM C39 "Compressive Strength of Cylindrical Concrete Specimens"
- iv. ASTM C42 "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete"
- v. ASTM C94 "Ready-Mixed Concrete"
- vi. ASTM C109 "Test of Hydraulic Cement Concrete"
- vii. ASTM C143 "Slump of Hydraulic Cement Concrete"
- viii. ASTM C150 "Portland Cement"
- ix. ASTM C172 "Sampling Freshly Mixed Concrete by the Volumetric Method"
- x. ASTM C192 "Making and Curing Concrete Test Specimens in the Laboratory"
- xi. ASTM C260 "Air-Entraining Admixtures for Concrete"
- xii. ASTM C330 "Lightweight Aggregates for Structural Concrete"
- xiii. ASTM C494 "Chemical Admixtures for Concrete"
- xiv. ASTM C618 "Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete"
- xv. ASTM C685 "Volumetric Batching and Continuous Mixing"
- xvi. ASTM C1157 "Hydraulic-Cement"

1.04 QUALITY ASSURANCE

- A. Tests and Inspections:
 - 1. Provide special inspections and testing as described in the "Statement of Structural Special Inspections and Testing" within the structural drawings and as required by this section.
 - 2. A testing program is required prior to start of construction. Testing program to be done in Compliance with the CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.
 - 3. The following tests shall be made by a recognized testing laboratory selected by the Owner and approved by the governing agency. All tests shall be in accordance with the previously mentioned standards and ACI 318 Section 26.12. A complete record of all tests and inspections shall be kept per CBC Section 1903.1.
 - i. Compressive Strength: Make and cure in accordance with ASTM C-31. Test in accordance with ASTM C-39 and ACI 318 Section 26.12.
 - 1) A record shall be made of time and of locations of concrete from which samples were taken.
 - 2) Four identical cylinders shall be taken from each pour of 150 cubic yards or 5000 square feet or part thereof, being placed each day per ACI 318 Section 26.12.2. One cylinder shall be tested at age 7 days, and two at age 28 days unless otherwise specified. Preserve remaining cylinder for future use.
 - i. Drying Shrinkage: (applies to lightweight concrete only unless noted otherwise)
 - 1) A record shall be made of time cylinders and of locations of concrete from which samples were taken.
 - 2) Three identical 4" x 4" x 11" specimens shall be made from same concrete as used in structure. Percent of shrinkage shall be reported

at 21 days after 7 day moist curing period. Average results of 3 specimens shall be used as the accepted value. The value for laboratory cast specimens shall not exceed .075%. If field test specimens are used in lieu of laboratory specimens, a tolerance of +33% may be used.

- 3) Test specimens in accordance with ASTM C157.
- i. Concrete consistency (slump) shall be tested in accordance with ASTM C143.
- 4. Provide full time inspection per CBC Section 1704.3 during the taking of test specimens and during the placing of all concrete and embedded steel.
- 5. See Section 03 21 00 for reinforcing steel tests and inspections.
- 6. Provide concrete batch plant inspections per ASTM C685.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- C. Submit the following.
 - 1. Concrete mix designs. See "Mix Design" below. Include results of test data used to establish proportions.
 - 2. Certificates of Compliance from Manufacturer
 - i. Cement certificates
 - ii. Aggregates
 - iii. Admixtures.
 - 3. Data regarding hardeners and sealers.
 - 4. Grout samples for sacked surface textures and colors upon Architects request only.
 - 5. Layout drawings for construction, control and expansion joints.
 - 6. Transit-mix delivery slips:
 - i. Keep record at the job site showing time and place of each pour of concrete, together with transit-mix delivery slips certifying contents of the pour.
 - ii. Make the record available to the Architect for his inspection upon request.
 - iii. Upon completion of this portion of the work, deliver the record and the delivery slips to the Architect.
 - 7. See Section 03 21 00 for reinforcing steel submittals.

1.07 DELIVERY, STORAGE AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.09 EXTRA MATERIALS

Not required.

1.10 <u>RECORD DRAWINGS</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Portland Cement: ASTM C 150, Type II or Type V. One brand of cement shall be used throughout to maintain uniform color for all exposed concrete.
- B. Concrete Aggregate: Fine and coarse aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as combination of sizes when two or more are used, shall conform to grading requirements of appropriate ASTM Standards and ACI 318.
 - 1. Concrete Aggregates for Standard Weight Concrete: ASTM C 33. Aggregate shall be crushed granite or Perkins type.
 - 2. Concrete Aggregates for Lightweight Concrete: ASTM C330 to produce concrete weighing no more than 115 pcf at 28 days. Aggregate shall be vacuum saturated expanded shale as produced through the rotary kiln method.
- C. Water: Clean and free from injurious amounts of oil, acids, alkali, organic matter and other deleterious substances; suitable for domestic consumption.
- D. Admixtures shall be subject to prior approval by the Architect, in accordance with ACI 318 Section 26.4.1.4. Calcium Chloride is not permitted.
 - 1. Water Reducing
 - i. ASTM C494 Type A for use in cool weather.
 - ii. ASTM C494 Type D for use in hot weather.
 - 2. Air Entraining
 - i. Conform to ASTM C 260
 - 3. Fly Ash
 - i. Conform to ASTM C 618

- 4. Mid-Range Water-Reducers
 - i. Master Builders "Polyheed" or approved equal.
- 5. Fly Ash Pozzolan
 - i. Conforming to ASTM A-618 Class F
- E. Slab on Grade Vapor Retarder
 - 1. Vapor Retarder must have the following qualities:
 - i. 15 mil thickness minimum
 - ii. WVTR less than 0.008 as tested by ASTM E 96
 - iii. ASTM E 1745 Class A (Plastics)
 - 2. Vapor Retarder Products
 - i. Stego Wrap Vapor Retarder by STEGO Industries LLC.
 - ii. Perminator by W.R. Meadows.
 - 3. Vapor Retarder Tape
 - i. Water Vapor Transmission Rate: ASTM E 96, 0.3 perms or lower
 - ii. Minimum 6-mils thick
 - iii. Minimum 3 3/4 inches wide
 - iv. Manufactured from High Density Polyethylene
 - v. Pressure Sensitive Adhesive
- F. Sand: Clean, dry, well graded.
- G. Abrasive aggregate for non-slip finish: Fused aluminum oxide grits, graded 12/30. Use factory-graded rustproof and non-glazing material that is unaffected by freezing, moisture and cleaning materials.
 - 1. Products offered by manufacturers to comply with the above requirements include: A-H Alox; Anti-Hydro Waterproofing Co., Toxgrip; Toch Div. Carboline, or approved equal.
- H. Expansion Joint Filler:
 - 1. Joint fill shall be a preformed non-extruded resilient filler, saturated with bituminous materials and conforming to ASTM D 1751. Products shall be equivalent to Burke "Fiber Expansion Joint", W.R. Meadows "Fibrated Expansion Joint Filler", or approved equal.
- I. Bonding Agent: Sonneborn "Sonobond"; the Euclid Chemical Company "Euco-Weld"; Larsen Products Corp., "Weld-Crete" or approved equivalent.
- J. Concrete Sealer: Cure and Seal, as manufactured by the Euclid Chemical Company "Aqua-Cure VOX", Sonneborn "Kure-N-Seal WB", Burke "Spartan-Cote", W.R. Meadows "Intex" or approved equal conforming to ASTM C-309, Type I, Class B requirements, and conforming to State of California Air Resources Board VOC Regulations.
- K. Concrete Hardener/Sealer: Clear, water soluble, sprayable in-organic silicate based hardener/sealer or acrylic co-polymer resin. Products shall be equal to Euclid Chemical Company "Eucosil", Burke "Spartan-Cote", Sonneborn "Sonosil", W.R. Meadows "Pena-Lith", or approved equal and must conform to State of California Air Resources Board VOC Regulations.
- L. Concrete Cure: Water based curing compound conforming to ASTM C-309, Type 1, Class A and B, and AASHTO Specification M-148; Type 1, Class A and B requirements, and State of California Air Resources Board VOC Regulations. Product shall be equivalent to Euclid Chemical Company "Kurez VOX", Burke "No. 1127" or "Aqua-Resin Cure", W.R. Meadows "1100 Clear", or approved equal.

M. Non-Shrink Grout: See Section 2.2.A.6.

2.02 CONCRETE

- A. Concrete Mixes:
 - Type A Concrete: Strength: 3000 lbs. per square inch at 28 days. Maximum Aggregate Size: 1-1/2 inch. Cement Content: As required by mix design (ACI 318 Section 26.4.3). 5.0 sacks per yard minimum. Maximum Water to Cement Ratio: 0.58 Admixture: Water Reducing. Weight: 145 lbs. per cubic foot Use for unexposed foundation concrete except as otherwise specified. At Contractor's option, Type B concrete may be substituted for this.
 - 2. Type B Concrete:
 - Strength: 3500 lbs. per square inch at 28 days.
 Maximum Aggregate Size: 1 inch.
 Minimum Cement Content: As required by mix design. (ACI 318 Section 26.4.3).
 5.5 sacks per yard minimum.
 Maximum Water to Cement Ratio: 0.45
 Admixture: Water reducing.
 Weight: 145 lbs. per cubic foot
 Use for building slab on grade
 - Type C Concrete: Strength: 4000 lbs. per square inch at 28 days. Maximum Aggregate Size: 1 inch. Minimum Cement Content: As required by mix design (ACI 318 Section 26.4.3).
 6.5 sacks per yard minimum. Maximum Water to Cement Ratio: 0.50 Admixture: Water reducing. Weight:145 lbs. per cubic foot Use for columns, beams, walls and overhead structural slabs except as otherwise specified
 - 4. Type D Concrete: Strength: 3500 lbs. per square inch at 28 days. Maximum Aggregate Size: 3/4 inch. Minimum Cement Content: As required by mix design (ACI 318 Section 26.4.3).
 6.0 sack per cubic yard minimum. Maximum Water to Cement Ratio: 0.52 Admixture: Water reducing. Weight:145 lbs. per cubic foot Use for normal weight concrete over metal deck
 - 5. Type E Concrete: Strength: 3,000 lbs. per square inch at 28 days. Maximum Aggregate Size: 3/4 inch. Minimum Cement Content: As required by mix design (ACI 318 Section 26.4.3).
 6.0 sacks per yard minimum. Maximum Water to Cement Ratio: 0.52 Admixture: Water reducing. Weight: 115 <u>+</u> 3 lbs. per cubic foot. Use for lightweight concrete over metal deck.
 - 6. Grout shall be non-shrink, non-metallic, flowable Type "713" or "928" by BASF.
 - i. Metallic grout equivalent to Master Builders "Embeco" may be used only where

covered by earth, concrete, or masonry.

- ii. Acceptance by Architect required before using.
- B. Consistency of Concrete: Concrete slump, measured in accordance with ASTM C 143, shall fall within following limits.
 - 1. For General concrete placement: 4 inch plus or minus 1 inch.
 - 2. Mixes employing the specified mid-range water reducer shall provide a measured slump not to exceed 7 inch <u>+</u>1 inch after dosing, 2 inch <u>+</u>1 inch before dosing.
 - 3. Concrete slump shall be taken at point of placement. Use water reducing admixtures as required to provide a workable consistency for pump mixers. Water shall not be added at the jobsite without written review by the structural engineer.
- C. Mix Design:
 - Initial mix design shall be prepared for all concrete in accordance with ACI 318 Section 26.4.3. Mix proportions shall be determined in accordance with ACI 318 Section 26.4.3 or 26.4.4. In the event that additional mix designs are required due to depletion of aggregate sources, aggregate not conforming to Specifications or at request of Contractor, these mixes shall be prepared as above.
 - 2. Contractor shall notify the Testing Laboratory and Architect of intent to use concrete pumps to place concrete so that mix designs can be modified accordingly.
 - 3. Fly ash shall not exceed 25% of the total cementitious material.
 - 4. Provide 6% air entrainment typical for exterior concrete exposed to freeze-thaw cycles.
 - 5. Owner's testing laboratory shall review all mix design before submittal.
- D. Mixing:
 - 1. Equipment: All concrete shall be machine mixed. Provide adequate equipment and facilities for accurate measurement and control of materials.
 - 2. Method of Mixing:
 - i. Transit Mixing: Comply with ASTM C 94. Ready mixed concrete shall be used throughout, except as specified below.
 - ii. On-Site Mixing: Use only if method of storing material, mixing of material and type of mixing equipment is approved by Architect. Approval of site mixing does not relieve Contractor of any other requirements of Specifications.
 - iii. Mixing shall be in accordance with ASTM C94 or ASTM C685.
 - 3. Mixing Time: After mix water has been added, concrete shall be mixed not less than 1-1/2 minutes nor more than 1-1/2 hours. Concrete shall be rejected if not deposited within the time specified.
 - 4. Admixtures:
 - i. Air entraining and chemical admixtures shall be charged into mixer as a solution and shall be dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighed or measured by volume as recommended by manufacturer. Accuracy of measurement of any admixture shall be within plus or minus 3%.
 - ii. Two or more admixtures may be used in same concrete, provided such admixtures are added separately during batching sequence, and provided further that admixtures used in that combination retain full efficiency and have no deleterious effect on concrete or on properties of each other.
 - iii. All admixtures are to be approved by Structural Engineer prior to commencing

this work.

- 5. Retempering:
 - i. Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall be discarded, not retempered.
 - ii. Indiscriminate addition of water to increase slump is prohibited.
 - iii. When concrete arrives at project with slump below that suitable for placing, water may be added only if neither maximum permissible water-cement ratio nor maximum slump is exceeded. Water shall be incorporated by additional mixing equal to at least half of total mixing time required. Any addition of water above that permitted by limitation of water-cement ratio shall be accompanied by a quantity of cement sufficient to maintain proper water-cement ratio. Such additions shall only be used if approved by Architect. In any event, with or without addition of cement, not more than 2 gallons of water per cubic yard of concrete, over that specified in design mix, shall be added.
- 6. Cold Weather Batching: When average of the highest and lowest air temperature falls below 40 degrees F for more than three consecutive days, provide adequate equipment for heating concrete materials. No frozen materials or materials containing ice shall be used. When placed in forms, concrete placed in these temperatures shall have a minimum temperature based on dimensions of concrete sections placed per ACI 301.
- 7. Hot Weather Batching: Concrete deposited in hot weather shall have a placing temperature below 90 degrees F per ACI 301. If necessary, ingredients shall be cooled to accomplish this.

2.03 FLOOR LEVELING AND FILL MATERIALS

- A. Epoxy Concrete Mortar: Floor leveling, non-shrink trowel applied epoxy concrete mortar; TPM 115 General Polymers Corp., A-H Emery Epoxy Topping #170 Anti-Hydro Corp., or approved equal, where areas to fill are less than 1/4 inch thick.
- B. Concrete Mortar: Floor leveling, patching and repair, non-shrink trowel applied concrete mortar; Master Builders EMBECO 885, Euclid EUCO, or approved equal, where areas of fill are greater than 1/4 inch thick.
- C. Cementitious Floor Leveling Material: Shall be self-leveling or trowelable with a minimum 28 day compressive strength of 3000 psi in accordance with ASTM C-109. Material shall be equal to Quickrete No. 1249, Ardex V-800/K-55, Mapei "Ultra/Flex" or approved equal.

PART 3 - EXECUTION

3.01 PLACEMENT

- A. Before any concrete is placed, the following items of work shall have been completed in the area of placing.
 - 1. Forms shall have been erected, adequately braced, cleaned, sealed, lubricated if required, and bulkheaded where placing is to stop.
 - 2. Any wood forms other than plywood shall be thoroughly water soaked before placing any concrete. The wetting of forms shall be started at least 12 hours before concreting.
 - 3. Reinforcing steel shall have been placed, tied and supported.
 - 4. Embedded work of all trades shall be in place in the forms and adequately tied and braced.
 - 5. The entire place of deposit shall have been cleaned of wood chips, sawdust, dirt, debris, hardened concrete and other foreign matter. No wooden ties or blocking shall be left in

the concrete except where indicated for attachment of other work.

- 6. Reinforcing steel, at the time the concrete is placed around it, shall be cleaned of scale, mill scale or other contaminants that will destroy or reduce bond.
- 7. Concrete surfaces to which fresh concrete is to be bonded shall be brush cleaned to remove all dust and foreign matter and to expose the aggregate, and then coated with the bonding adhesive herein specified.
- 8. Prior to placing concrete for any slabs on grade, the moisture content of the subgrade below the slabs shall be adjusted to at least optimum moisture.
- 9. No concrete shall be placed until formwork and reinforcement has been approved by Architect. Clean forms of all debris and remove standing water. Thoroughly clean reinforcement and all handling equipment for mixing and transporting concrete. Concrete shall not be placed against reinforcing steel that is hot to the touch. Notify Structural Engineer 48 hours in advance of concrete pour.
- B. Conveying: Handle concrete from mixer to place of final deposit by methods which will prevent separation or loss of ingredients. Deposit concrete in forms as nearly as practicable at its final position in a manner which will insure that required quality is obtained. Chutes shall slope not less than 4 inches and not more than 6 inches per foot of horizontal run.
- C. Depositing: Deposit concrete into forms in horizontal layers not exceeding 24 inches in thickness around building, proceeding along forms at a uniform rate and consolidating into previous pour. In no case shall concrete be poured into an accumulation of water ahead of pour, nor shall concrete be flowed along forms to its final place of deposit. Fresh concrete shall not be permitted to fall from a height greater than 6 feet without use of adjustable length pipes or, in narrow walls, of adjustable flexible hose sleeves. Concrete shall be scheduled so that placing is a continuous operation for the completion of each section between predetermined construction joints. If any concreting operation, once planned, cannot be carried on in a continuous operation, concreting shall stop at temporary bulkheads, located where resulting construction joints will least impair the strength of the structure. Location of construction joints shall be as shown on the drawings or as approved by Structural Engineer. The rate of rise in walls shall not be less than 2 feet per hour.
 - 1. Consolidation: Concrete shall be thoroughly compacted and worked to all points with solid continuous contact to forms and reinforcement to eliminate air pockets and honeycombing. Power vibrators of approved type shall be used immediately following pour. Spading by hand, hammering of forms or other combination of methods will be allowed only where permitted by Structural Engineer. In no case shall vibrators be placed against reinforcing steel or used for extensive shifting of deposited fresh concrete. Provide and maintain standby vibrators, ready for immediate use.
 - 2. Hot Weather Concreting: Unless otherwise directed by the Architect, perform all work in accordance with ACI 305 when air temperature rises above 75 degrees F and the following:
 - i. Mixing Water: Keep water temperature as low as necessary to provide for the required concrete temperature at time of placing. Ice may be required to provide for the design temperature.

Aggregate: Keep aggregate piles continuously moist by sprinkling with water. Temperature of Concrete: The temperature of the concrete mix at the time it is being placed in the forms shall not exceed 90 degrees F per ACI 301. The method employed to provide this temperature shall in no way alter or endanger the design mix or the design strength required.

Dampen subgrade and formwork before placing concrete. Remove all excess water before placing concrete. Keep concrete continuously wet when air temperature exceeds 85 degrees F for a minimum of 48 hours after placing concrete. For slab on grade construction, see Section 3.1.E.

Protection: Minimize evaporation from concrete in place by providing shade and windbreaks. Maintain such protection in place for 14 days minimum.

- 3. Cold Weather Concreting: Follow recommended ACI 306 procedures when average of the highest and lowest air temperature falls below 40 degrees F for more than three consecutive days, as approved by Architect. Concrete placed in these temperatures shall have a minimum temperature based on dimensions of concrete sections placed as shown in ACI 301. No chemicals or salts shall be used to prevent freezing and no accelerating agents shall be used without prior approval from Architect.
- D. Construction Joints: Install only as indicated and noted on Drawings. Joints not indicated on Drawings shall be so located, when approved, as to least impair strength of structure, and shall conform to typical details. Construction joints shall have level tops, vertical sides. Horizontal construction joints shall be thoroughly cleaned and roughened by removing entire surface film and exposing clean aggregate solidly embedded in mortar matrix. Joints between concrete and masonry shall be considered construction joints. Vertical construction joints need not be roughened. See Drawings for doweling and required keys.
 - 1. Roughen construction joints by any of following methods:
 - i. By sandblasting joint.
 - ii. By thoroughly washing joint, using a high pressure hose, after concrete has taken initial set. Washing shall be done not less than 2 hours nor more than 4 hours after concrete has been poured, depending upon setting time.
 - iii. By chipping and wire brushing.
 - 2. All decisions pertaining to adequacy of construction joint surfaces and to compliance with requirements pertaining to construction joints shall be reviewed with the Structural Engineer.
 - 3. Just before starting new pour, horizontal and vertical joint surfaces shall be dampened (but not saturated).
 - 4. Before placing regular concrete mix, horizontal construction joint surfaces shall be covered with a layer of mortar composed of cement and fine aggregate of same proportions as that used in prescribed mix, but omitting coarse aggregate.
 - 5. For slabs, construction joints shall be in locations shown on plan. If not shown, locate at intervals not exceeding 150 feet in each direction. Refer to drawings for proper details for reinforcing at construction joints.
- E. Concrete Slabs on Grade:
 - 1. Exterior and interior concrete slabs on grade shall be poured as required under this Section. Base shall be accurately leveled and compacted prior to placing of concrete.
 - 2. Typically, interior slabs on grade shall be poured over a minimum of four (4 inch) inches of compacted crushed rock, unless otherwise indicated, over a vapor retarder.
 - 3. Protect slab on grade subbase from moisture prior to placing concrete. Avoid wetting rock layer to allow adequate concrete curing and avoid future vapor transmission. If the subbase has been wet excessively, verify that water has been eliminated prior to placement of concrete.
 - 4. Vapor Retarder installation shall be in accordance with manufacturer's instructions and ASTM E 1643.
 - i. Unroll Vapor Retarder with the longest dimension parallel with the direction of the pour.
 - ii. Lap Vapor Retarder over footings and seal to foundation walls.
 - iii. Overlap joints 6 inches and seal with specified tape.
 - iv. Seal all penetrations (including pipes) per manufacturer's instructions.

- v. No penetration of the Vapor Retarder is allowed except for reinforcing steel and permanent utilities.
- vi. Repair damaged areas by cutting patches of Vapor Retarder, overlapping damaged area 6 inches and taping all four sides with tape.
- F. Control Jointing Slabs on Grade:
 - 1. Joints shall be in locations indicated on Drawings, or as directed by Architect.
 - 2. Joints in interior slabs shall be made by one of following methods:
 - i. By use of construction joints laid out in checkerboard pattern; pour and allow alternate slabs to set; fill out balance of checkerboard pattern with second pour.
 - ii. By use of dummy groove joints at least 1/4 depth of slab, and at least 1/8 inch wide. These joints may be sawcut as soon as wet concrete can support the weight of the equipment and operator. Delaying sawcutting past this point will make jointing ineffective.
 - 3. Control jointing in exterior paving slabs shall be laid out in a checkerboard pattern; pour as described above, but with joint edges tooled to provide a uniform joint at least 3/8 inch in depth.
 - 4. Slab reinforcing need not be terminated at control joints.
 - 5. Construction and expansion joints shall be counted as control joints.
- G. Expansion Joints:
 - 1. Unless otherwise indicated, use 3/8 inch thick expansion joint filler. See Section 2.1.H
 - 2. Joints in interior slabs on grade shall be only in locations indicated.
 - 3. Joints in exterior slabs on grade shall be installed at each side of structures, at curb transitions opposite apron joints, at ends of curb returns, at back of curb when adjacent to sidewalk, and at uniformly spaced intervals not exceeding 20 feet.
 - 4. Edges of concrete at joints shall be edger finished to approximately 3/8 inch radius.
 - 5. Interrupt reinforcing at all expansion joints.
- H. Score markings on exterior slabs on grade shall be located as indicated. Where not indicated, mark slabs into rectangles of not less than 12 square feet nor more than 20 square feet using a scoring tool which will leave edges of score markings rounded.

3.02 CURING AND PROTECTION

- A. Curing: Exposed surfaces of all concrete used in structure shall be maintained in a moist condition for at least 7 days after placing. The following final curing processes shall normally be considered to accomplish this. Concrete shall be maintained at not less than 50 degrees F nor more than 100 degrees F for a period of 72 hours after being deposited.
 - 1. Flatwork to be exposed, stained, or painted shall have curing process submitted and approved by the architect prior to construction.
 - 2. Initial Curing Process Flat Work:
 - i. Mist Spraying: As soon as troweling of concrete surfaces is completed, exposed concrete shall be sprayed continuously with a special atomizer spray nozzle, capable of producing a fine mist. Spraying shall be done without any dripping of water from nozzle. Amount of spraying shall be such as to maintain surface of concrete moist without any water accumulating on surface. Maintain spraying for a minimum of 12 hours, or until such time as hereinafter described curing process is applied. Mist spraying will not normally be required when the ambient air temperature is below 90 degrees F.

- 3. Final Curing Process Flatwork: Except as noted, use any of following:
 - i. Water Curing: Concrete shall be kept wet by mechanical sprinklers or by any other approved method which will keep surfaces continuously wet.
 - ii. Saturated Burlap Curing: Finished surfaces shall be covered with a minimum of two layers of heavy burlap which shall be kept saturated during the curing period.
 - iii. Curing Compounds: Membrane curing compounds of chlorinated rubber or resin type conforming to ASTM C309 may be used only if specifically approved by Architect. Use of membrane curing compound will not be permitted on surfaces to be painted, or to receive ceramic tile, membrane water-proofing or hardeners and sealers. Membrane curing compound may be used in areas to receive resilient floor tile, provided it is wax-free, compatible with adhesive used and approved by adhesive manufacturer. Agitate curing compounds thoroughly by mechanical means continuously during use and spray or brush uniformly in accordance with manufacturer's recommendations. Apply immediately following final finishing operation. All curing compounds shall conform to State of California Air Resources Board VOC Regulations.
 - iv. Waterproof paper conforming to ASTM C 171, or opaque polyethylene film, may be used. Concrete shall be covered immediately following final finishing operation. Anchor paper or film securely and seal all edges in such a manner as to prevent moisture escaping from concrete.
- 4. Curing Process Formed Surfaces: Forms heated by sun shall be kept moist during curing period. If forms are to be removed during curing period, curing as described for flatwork shall be commenced immediately.
- B. Refer to Drawings for areas of concrete slab not to receive curing compounds or hardening compounds. Where concrete floors are to receive heavy duty coatings, waterproof coatings and the like, verify with coating installer the type of finish required for specified coating.
- C. Protection: Contractor shall be responsible for protection of finished concrete against injury by rain, cold, vibration, animal tracks, marking by visitors, vandalism, etc.
- D. Provide additional curing agents or compounds, not necessarily listed herein, but as recommended and or required for use with shake type hardeners or other special coatings and coverings by their manufacturers for a complete and proper installation.

3.03 <u>FINISHES</u>

- A. Formed Surfaces:
 - 1. Rough Form Finish: Surfaces shall be reasonably true to line and plane with no specified requirements for selected facing materials. Tie holes and defects shall be patched and fins exceeding 1/4 inch in height shall be rubbed down with wooden blocks. Fins and other rough spots at surfaces to receive membrane waterproofing shall be completely removed and the surfaces rubbed smooth. Otherwise, surfaces shall be left with the texture imparted by forms.
 - i. Rough finish shall be used for the following areas:
 - 1) Below grade and unexposed surfaces.
 - 2.. Smooth Plywood Form Finish: Finish shall be true to line and plane. Tie holes and defects shall have been patched and ground with surface fins removed. Arrangement of plywood sheets shall be orderly, symmetrical, as large as practical and free of torn grain or worn edges. Surface concrete shall be treated with 1 part muriatic acid, in three parts water solution, followed immediately by a thorough rinsing with clear water. Surfaces which are glazed, have efflorescence, or traces of form oil, curing compounds or parting compounds shall be cleaned or treated to match other formed surfaces, except as

otherwise indicated or specified.

- i. Smooth Plywood Form Finish shall be used for the following areas:
 - 1) All surfaces above grade unless otherwise specified.
 - 2) At Contractor's option, may also be used in lieu of rough form finish.
- 3. Smooth Plastic Liner Finish: Surface shall be smooth, concrete free of honeycombing, air pockets larger than 1/8 inch in diameter, and fins.
 - i. This finish shall be used only where indicated on the Drawings.
- B. Flatwork:
 - 1. Unless otherwise indicated or specified, flatwork shall have an integral monolithic finish.
 - 2. Integral Monolithic Finish: Apply as soon as freshly poured concrete slabs will bear weight of workers. Pour slabs full thickness to finish floor elevations indicated. At proper time, tamp surface repeatedly with a wire mesh or grid tamper in a manner to force aggregate down below surface and to bring sufficient mortar to surface to provide for a smooth coating of cement mortar over entire surface. Allow surface mortar to partially set, then float with wooden floats and finish with one of following, as required.
 - i. Broom Finish: Steel trowel surface to a smooth dense surface free of lines, tool marks, cat faces and other imperfections. After troweling, and before final set, give surface a broom finish, brushing in direction noted on Drawings, or as directed. Broom finish shall be used typically on exterior flatwork except as otherwise indicated or specified and shall be "medium" texture as approved by Architect.
 - ii. Smooth Steel Trowel Finish: Apply 2 steel trowelings to obtain hard, smooth surface. All lips, irregularities, uneven levels, etc. shall be worked out before last troweling. All interior flatwork shall have a smooth steel trowel finish unless specified otherwise.
 - 3. Tolerances:
 - i. For tolerances not indicated, refer to ACI 117.
 - ii. Slabs on grade Comply with $F_F \& F_L$ as specified by Architect, or at a minimum shall be sufficiently even to contact a 10' long straightedge with a tolerance of 1/8 inch.
 - iii. Concrete over metal deck Refer to Section 05 30 00 for minimum requirements.
 - iv. Elevated slabs Comply with Architectural requirements.
 - v. Finished surfaces of exterior integral finished flatwork shall not vary more than 1/4 inch from a 10' long straightedge, except at grade changes.
- C. Sacked Surfaces: Exposed surfaces that are unacceptable in appearance to the Architect shall be sacked.
 - 1. Prepare concrete surfaces in accordance with the referenced standards. Remove any form release materials by stoning by hand, power grinding or other method approved by the Architect.
 - 2. Prepare concrete surfaces to receive sack finishing with a light sand blasting.
 - 3. For best results, grout application and rubbing should be performed when areas to be treated are shaded and during cool, damp weather. When work is to be performed in hot and dry weather, a fog spray should be available for continuous use.
 - 4. Prepare grout samples for matching of concrete surfaces for approval by the Architect. These shall be made in the following proportions of gray cement to white cement to sand: 1:1:2, 1:2:3, and 2:1:3, etc. until the correct matching color is obtained on the test areas.

Sand should be fine enough to pass the Number 30 sieve. Mixes should be made to a good workable consistency in a clean container and the mix with the best color chosen, or modified if needed.

- 5. Provide sufficient qualities of sand and cement from the same source for the complete work at the job site.
- 6. Mixing and Application:
 - i. Mixing of grout on the job should be timed for it to be used up within 1 to 1-1/2 hours.
 - ii. Let the grout stand 20 to 30 minutes after mixing, and then remixed before applying.
 - iii. Soak the concrete surface thoroughly with water at least 15 minutes before applying grout and again just before application so that the surface is adequately wet during the operation.
 - iv. Apply grout with plasterer's trowel or sponge rubber float in sweeping strokes from the bottom up. Brush or spray gun applications may be used when approved by the Architect.
 - v. Work in freshly applied grout vigorously with a sponge rubber float, then let sit until some of its plasticity is gone but not until it loses its damp appearance. At this point it shall be rubbed with clean, dry burlap to remove the excess grout, leaving no visible film on the surface but filling all air holes.
 - vi. Keep the surface wet for a day after grouting and sack rubbing are completed.
- 7. Alternate methods of application and materials shall be subject to the approval of the Architect.

3.04 PATCHING

- A. Formed Surfaces:
 - 1. Promptly upon removal of contact forms and after concrete surfaces have been inspected, form ties shall be removed and all necessary patching and pointing shall be expertly done.
 - 2. Honeycombed areas shall be removed down to sound concrete, coated with a bonding grout or approved compound and patched using a low shrinkage high bond mortar. Patched areas shall be cured by being kept damp for at least 5 days.
 - 3. Tie holes shall be cleaned, dampened and filled solid with patching mortar or cement plugs of an approved variety.
- B. Slabs on Grade: After entire slab is finished, shrinkage cracks that may appear shall be patched as follows:
 - 1. Where slab is not exposed or where appearance is not important, cracks larger than 1/32 inch wide shall be filled with cement grout and struck off level with surface.
 - 2. Where slab is exposed and appearance is important, unsightly cracks shall be repaired in a manner satisfactory in appearance to Architect. If this cannot be accomplished, concrete shall be considered defective.

3.05 DEFECTIVE CONCRETE

- A. Defective concrete shall mean any of the following:
 - 1. Concrete not meeting 100 percent of the specified 28 day compressive strength.
 - 2. Concrete exhibiting rock pockets, voids, spalls, streaks, cracks, exposed reinforcing to extent that strength, durability, or appearance is adversely affected.
 - 3. Concrete significantly out of place, line, or level.
 - 4. Concrete not containing the required embedded items.

- B. Upon determination that concrete strength is defective:
 - 1. Should cylinder tests fall below minimum strength specified, concrete mix for remainder of work shall be adjusted to produce required strength. Core samples shall be taken and tested from cast-in-place concrete where cylinders and samples indicate inferior concrete with less than minimum specified strength.
 - Cores of hardened concrete shall be taken and tested in accordance with ASTM C 42 and C 39. Number and location of such cores shall be subject to the approval of Architect.
 - ii. Cost of core sampling and testing will be paid for by the Contractor.
 - iii. "85 percent" reduction in ACI 318 Section 26.12.4 will not justify low cylinder tests.
- C. Upon determining that concrete surface is defective, Contractor may restore concrete to acceptable condition by cutting, chipping, pointing, patching, grinding, if this can be done without significantly altering strength of structure. Permission to patch defective areas will not be considered a waiver of the right to require removal if patching does not, in the opinion of the Architect, satisfactorily restore quality and appearance.
- D. If core tests indicate that concrete is below the strength specified, or if patching does not restore concrete to specified quality and appearance, the concrete shall be deemed defective, and shall be removed and replaced without additional cost to the Owner.
- E. No repair work shall begin until procedure has been reviewed by the Architect and Structural Engineer.

3.06 SURFACE HARDENER AND SEALER

- A. Seal all interior exposed flatwork with clear sealer, except surfaces receiving ceramic tile, quarry tile, poured flooring or other special finishes specified, or as scheduled on the Drawings.
 - 1. Apply sealer in 2 or 3 coats, in accordance with manufacturer's directions, using the maximum quantity recommended.
 - i. Concrete floors must be thoroughly cured for a minimum of 30 days and completely dry before treatment.
 - ii. Surfaces to be treated must be clean, free of membrane curing compounds, dust, oil, grease and other foreign matter.
 - iii. Upon completion, concrete surfaces shall be clean and without discoloration or traces of excess hardener left on the surface.
- B. Apply sprayable hardener/sealer at locations as scheduled or as indicated on the Drawings. Apply in accordance with the manufacturer's favorably reviewed application instructions and recommendations.

3.07 <u>GROUTING</u>

- A. Prepare and place grout materials at locations as indicated on the Drawings in accordance with the manufacturer's recommendations and installation instructions.
- B. Pack grout materials solidly between bearing surfaces and bases or plates as indicated and to ensure no voids.
- 3.08 ADJUSTING AND CLEANING
 - A. Remove all debris, excess materials, tools and equipment resulting from or used in this operation at completion of this work.

END OF SECTION

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SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Furnish and install all structural steel as shown and specified including, but not necessarily limited to the following:
 - 1. Prime coat painting and touch up.
 - 2. All cast-in-place anchor bolts, nuts, plates, etc.
 - 3. 10 gauge steel or 3/4 inch plywood templates for column anchor bolts.
- B. Related Work
 - 1. Metal Fabrications: Section 05 50 00.
 - 2. Cast-In-Place Concrete: Section 03 30 00.
 - 3. Welding of Moment Resisting Frames: Section 05 12 24.

1.03 STANDARDS AND REFERENCES

- A. Except where other requirements are specified, comply with the following standards (latest edition unless noted otherwise)
 - 1. AISC 360-10 "Specification for Structural Steel Buildings".
 - 2. AISC 303-10 "Code of Standard Practice for Steel Buildings and Bridges".
 - 3. AISC 341-10 "Seismic Provisions for Structural Steel Buildings"
 - 4. AISC 358-10 "Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications"
 - 5. RCSC "Specifications for Structural Joints Using High Strength Bolts".
 - 6. AISC 303-10 Section 10, Architecturally Exposed Structural Steel, Code of Standard Practice for Steel Buildings and Bridges
 - 7. AWS D1.1 "Structural Welding Code Steel" latest edition
 - 8. AWS D1.8 "Structural Welding Code Seismic Supplement" latest edition
 - 9. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".
 - 10. SSPC-Vis 1 Pictorial Surface Preparation Standards for Painting Steel Structures
 - 11. SSPC-SP2 Hand Tool Cleaning
 - 12. SSPC-SP3 Power Tool Cleaning
 - 13. SSPC-SP6 Commercial Blast Cleaning
 - 14. SSPC-PA2 Measurement of Dry Paint Thickness with Magnetic Gauges

15. California Building Code (CBC) – latest edition

1.04 QUALITY ASSURANCE

- A. General:
 - 1. Comply with the referenced ASTM standards for materials.
 - 2. Perform all welding only with AWS certified welders.
 - 3. Verification of accuracy:
 - i. Engage and pay for a registered civil engineer or licensed land surveyor to check the alignment, plumbness, elevation, and overall accuracy of the erected framing at appropriate stages during construction and at completion of erection. Prior to erection, a survey shall be made of the as-built locations of all anchor rods and other embedded items associated with the attachment of structural steel. The party providing the survey shall submit written verification that the entire installation is in accordance with the contract documents and meets the allowable erection tolerances as set forth in the AISC "Code of Standard Practice for Steel Buildings and Bridges".
 - ii. Columns shall be verified at each lift. Column shim details and procedures shall be submitted for review.
 - 4. Paint:
 - i. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use thinners approved by paint manufacturer, and use within recommend limits.
 - ii. Coordination of Work: Review other Sections in which prime paints are to be provided to ensure compatibility of coatings system for various substrates. Upon request, furnish information or characteristics of finish materials to be used.
 - iii. Requirements of Regulatory Agencies: Comply with applicable rules and regulations of governing agencies for air quality control.
- B. Tests and Inspections:
 - 1. Provide special inspections and testing as described in the "Statement of Structural Special Inspections and Testing" within the structural drawings and as required by this section.
 - 2. Testing Laboratory:
 - i. All materials, work, methods and equipment shall be subject to inspection at the mill, fabricating plant and at the building site. Material or workmanship not complying fully with the Contract Documents will not be accepted. The Contractor shall give the Testing Laboratory reasonable notice when ready for inspection and shall supply samples and test pieces and all facilities for inspection without extra charge. The Owner will assume the expense of making the tests and inspection except as otherwise specified in Division 1.
 - 3. Cost of Testing and Inspection: Costs of testing and inspection of structural steel, except as specified hereunder and in Division 1, will be paid for by the Owner.
 - i. All transportation costs and per diem living costs for inspection at fabricators' plant further than 75 miles from the job site will be back-charged to the Contractor.
 - ii. It is assumed that all fabrication will take place in one shop location only. All additional inspection costs will be back-charged to the Contractor.
 - iii. All mill tests and costs of re-test of plain materials shall be at the expense of the

Contractor.

- iv. Costs of tests required due to Contractor's failure to provide steel identifiable in accordance with the indicated ASTM designation shall be at the expense of the Contractor.
- 4. Structural Steel Testing and Inspection:
 - i. Structural Steel: If structural steel tests are indicated as required on the structural drawings, one tension and one bend test shall be made for each size of structural shape, plate and for each tube and pipe size. Tests to be made in accordance with requirements of appropriate ASTM designations.
 - ii. If structural steel tests are not indicated as required on the structural drawings, then for shapes, plates, bars, pipe and tubing, manufacturer's certified mill test reports and analysis for each heat will be acceptable for steel identifiable in accordance with indicated ASTM designation. Mill test reports shall indicate the physical and chemical properties of all structural steel used. Correlate individual heat numbers with each specified structural section.
 - iii. Unidentifiable Steel:
 - 1) For Fy less than or equal to 36.0 ksi : Provide one tension and elongation test and one bend for each 5 tons or fraction thereof for each size.
 - 2) For Fy greater than 36.0 ksi : Provide one tension and elongation test and one bend or flattening for each piece.
 - iv. Costs of retests and additional testing required by the use of unidentifiable steels shall be the Contractor's responsibility. Additional costs of testing incurred by the Owner shall be deducted from the Contract Final Payment.
- 5. Expansion Anchors: Load test as indicated on drawings.
- 6. Welding Inspection:
 - i. For Moment Resisting Frame Welding inspection and testing requirements, see specification Section 05 12 24 Welding of Moment Resisting Frames.
 - ii. If shop or field welding inspection is indicated on the structural drawings or required by the applicable referenced standards, shop and field welded operations shall be inspected in accordance with AISC 360 Section N by a qualified welding inspector employed by the Testing Laboratory. Such inspector will be a person trained and thoroughly experienced in inspection of welds. The inspector's ability to distinguish between sound and unsound welding will be reliably established
 - iii. The welding inspector will make a systematic record of all welds. This record shall include:
 - 1) Identification marks of welders.
 - 2) List of defective welds.
 - 3) Manner of correction of defects.
 - iv. The welding inspector will check the material, equipment and procedure, as well as the welds. He will also check the ability of the welder. He will furnish the Architect with a report, duly verified by him that the welding which is required to be inspected is proper, and has been done in conformity with the Contract Documents, and that he has used all means to determine the quality of the welds.
 - v. All full penetration groove welds will be subject to ultrasonic testing, as per AWS

D1.1, Clause 6 "Inspection, Part "F", Ultrasonic Testing (UT) of Groove Welds. All defective welds shall be repaired and retested with ultrasonic equipment at the Contractor's expense.

- vi. Column Flanges: An area extending 6 inches above and below point where girder flanges are attached will be inspected. Column flange edges will be inspected visually and entire area ultrasonically for lamination, plate discontinuities, and non-metallic inclusions.
- vii. When ultrasonic indications arising from the weld root can be interpreted as either a weld defect or the backing strip itself, the Engineer will be notified. The Engineer may require the removal of backing strip. The backing strip will be removed at the expense of the Contractor, and if no root defect is visible the weld will be retested. If no defect is indicated on this retest, and no significant amount of base and weld metal have been removed, no further repair of welding is necessary. If a defect is indicated, it will be repaired and retested at Contractor's expense.
- viii. The ultrasonic instrumentation will be calibrated by the technician to evaluate the quality of the welds in accordance with AWS D1.1.
- ix. Other methods of inspection, for example, X-Ray, gamma ray, magnetic particle, or dye penetrant, may be used on welds if felt necessary by the inspection laboratory, and with the approval of the Engineer.
- x. Base metal thicker than 1-1/2 inches, when subjected to through thickness weld shrinkage strains, shall be ultrasonically inspected for discontinuities directly behind such weld before and after joint completion.
- xi. End-welded studs shall be sampled, tested, and inspected per the requirements of AWS D1.1, Clause 7 Stud Welding.
- xii. At the discretion of the owner's testing agency, the ultrasonic testing frequency may be reduced but may not be less than the following:
- xiii. Initially, all welds requiring ultrasonic testing will be tested at the rate of 100 percent in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5 percent of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25 percent. If the reject rate increases to 5 percent or more, 100 percent testing will be re-established until the rate is reduced to less than 5 percent. The percentage of rejects will be calculated for each welder independently.
- xiv. A sampling of a least 40 completed welds will be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over 3 ft in length where the effective throat is 1" or less, each 12 inch increment or fraction thereof shall be considered as one weld. For evaluating the reject rate of continuous welds over 3 ft in length where the effective throat is greater than 1", each 6 inch of length or fraction thereof shall be considered one weld.
- 7. High Strength Bolting Tests and Inspection:
 - Furnish certified test reports for each lot of bolts in accordance with Section 9 of ASTM A325 and A490. Install bolts under the supervision of a qualified inspector in accordance with Section 9, Research Council "Specifications for Structural Joints using ASTM A325 or A490 Bolts".
 - ii. If high strength bolting inspection is indicated on the structural drawings or required by the applicable referenced standards, the testing laboratory shall provide inspection in accordance with AISC 360 Section N.

- iii. While the work is in progress, the Inspector shall determine that the requirements of this Specification are met in the work. The Inspector shall observe the calibration procedures and shall monitor the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is properly used to tighten all bolts.
 - In addition to the requirement of the foregoing paragraph, for all connections specified to be slip critical (SC), the Inspector shall assure that the specified procedure was followed to achieve the pretension specified in the AISC. The pretension shall be verified by the inspector for these bolts.
 - Bolts in connections identified as not being slip-critical nor subject to direct tension need not be inspected for bolt tension other than to ensure that the piles of the connected elements have been brought into snug contact.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- C. Provide the following:
 - 1. Product Data: Include laboratory test reports and other data to show compliance with specifications (include specified standards). Include certified copies of mill reports covering chemical and physical properties of each type of structural steel.
 - 2. Shop Drawings:
 - i. Shop drawings shall include complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.
 - ii. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.
 - iii. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.
 - iv. Dimensions required to locate structural steel for manufactured items such as mechanical equipment, electrical equipment, dock levelers, etc., shall be coordinated and provided by the General Contractor. General Contractor shall also coordinate and provide dimensions to locate structural steel for window washing supports such as davits, tie-backs, etc.
 - 3. Procedures:
 - i. Provide weld procedures for both prequalified welds and special welds to be submitted to the Owner's Testing Laboratory and the Architect.
 - ii. Provide installation procedure and inspection for direct tension indicator washers detailed in supplemental specifications provided by the manufacturer for approval.

iii. Procedures shall be submitted for both shop and field welds.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
- D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.08 OPERATION AND MAINTENANCE

Not required.

1.09 EXTRA MATERIALS

Not required.

1.010 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.011 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

1.012 SEQUENCING/SCHEDULING

A. Cooperate and coordinate this work with other trades for anchor bolts, and other required inserts, templates, etc. Align this work prior to installation of other materials.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural Steel: Except where indicated on drawings.
 - 1. W shapes: ASTM A572-50 or ASTM A992-50 unless indicated otherwise on drawings.
 - 2. Channels and other rolled shapes: ASTM A36 unless indicated otherwise on drawings.
 - 3. Angles, plates and bars: ASTM A36 unless indicated otherwise on drawings.
- B. AISC group 4 and 5 shapes and plates greater than 2 inches thick: ASTM A36 and/or ASTM A572 Grade 50 with supplementary requirements S91 Fine Austenitic Grain Size and S5 Charpy

V-Notch Impact Test. For location of Charpy V-Notch test, see ASTM A6 Supplementary Requirement S30. Charpy V-Notch test shall be per ASTM A673, frequency P and shall meet a minimum average value of 20 ft-lbs absorbed energy at 70° F.

- C. Cold-Formed Steel Tubing: ASTM A500, Grade B.
- D. Steel Pipe: ASTM A53, Type E or S, Grade B.
- E. Anchor Bolts: All anchor bolts cast in concrete or masonry shall be headed bolts with cut threads conforming to ASTM F1554 grade 36, 55 (weldable per S1 Supplementary Requirements), or 105 as indicated on drawings.
- F. Machine Bolts: ASTM A307.
- G. High Strength Bolts, Nuts and Washers: Install in accordance with requirements for A325 and A490 slip critical and snug tight conditions as indicated on drawings. Install high strength bolts with snug tight type connections with threads included in shear plane except as otherwise noted. Install hardened washers in conformance with AISC Specifications.
 - Bolt Specifications: Bolts shall conform to the requirements of the current edition of the Specifications of the American Society for Testing and Materials for High-Strength Bolts for Structural Steel Joints, ASTM A325, Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength, ASTM A490 as indicated on drawings.
 - 2. Bolt Geometry: Bolt dimensions shall conform to the current requirements of the American National Standards Institute for Heavy Hex Structural Bolts, ANSI Standard B18.2.1. The length of bolts shall be such that the end of the bolt will be flush with or outside the face of the nut when properly installed.
 - 3. Nut Specifications: Nuts shall conform to the current chemical and mechanical requirements of the American Society for Testing and Materials Standard Specification for Carbon and Alloy Steel Nuts, ASTM A563, Appendix Table X1.1. Provide Grade A Heavy Hex nuts for Grade 36 and 55 threaded rods. Provide Grade DH or ASTM A194-2H Heavy Hex nuts for Grade 105 threaded rod.
 - 4. Washers: Flat circular washers and square or rectangular beveled washers shall conform to the current requirements of the American Society for Testing and Materials Standard Specification for Hardened Steel Washers, ASTM F436. Washers for base plates shall be placed top and bottom of plate and shall be ASTM A36 square or circular unless ASTM F844 are permitted on the drawings.
 - 5. Tension Control Fastener System: Bolts shall conform to the requirements of the current edition of the Specifications of the American Society for Testing and Materials for Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, ASTM F1852, providing equivalent properties to ASTM A325 or A490 as indicated on drawings.
- H. Headed Stud-Type Shear Connectors: ASTM A108 Grade 1015 or 1020 Cold-finished carbon steel with dimensions complying with AISC Specifications.
 - 1. Tensile strength, 60,000 psi.
 - 2. Elongation in 2 inches, 20 percent
 - 3. Reduction of area, 50 percent.
- I. Provide hexagonal heads and nuts for all connections per ASTM A563, Appendix Table X1.1.
- J. Electrodes for Welding: Comply with AWS Code, E70 Series minimum. Fabricator to select proper electrodes according to weld procedures as submitted.
- K. Shop Primer See Section 3.4, Painting and Cleaning
- L. Powder Driven Fasteners (Shot Pins): Tempered steel pins with special corrosive resistant plating or coating. Pins shall have guide washers to accurately control penetration. Fastening shall be accomplished by low-velocity piston-driven power activated tool. Pins and tool shall be as

manufactured by Hilti Fastening Systems.

M. Expansion Bolts: Hilti Fastening Systems "Kwik-Bolt Concrete Expansion Anchors" to concrete; Ramset "Dynabolt Sleeve Anchors" to masonry or approved equal.

PART 3 - EXECUTION

3.01 FABRICATION

A. Shop Fabrication and Assembly: Fabricate and assembly structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated to provide the flattest floor possible. The contractor shall coordinate member tolerances with finishes.

Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

- B. Connections: Weld or bolt shop connections, as indicted. Bolt field connections, except where welded connections or other connections are indicated.
- C. Unless noted otherwise, make holes 1/16 inches larger than the nominal bolt diameter.
- D. Welding, Shop and Field: Weld by shielded arc method, submerged arc method, flux cored arc method, or other method approved by AWS. Perform welding in accordance with AWS Code. All welders, both manual and automatic, shall be certified in accordance with AWS "Standard Qualification Procedure" for the Work to be performed. See paragraph "welding" herein, for detailed requirements. If sizes of fillet welds are not shown on drawings, use AWS minimum weld size but not less than 3/16 inch fillet welds.
- E. Bolt Holes for Other Work: Provide holes required for securing other work to structural steel framing.

Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.

Cut, drill, or punch holes perpendicular to metal surfaces and remove all burrs. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

- F. AISC Group 4 and 5 shapes and built up members shall meet the requirements for joints in AISC Sections J1.5, J1.6, J2.7 and M2.2.
- G. High Strength Bolts:
 - 1. Installation and Tightening:
 - i. Handling and Storage of Fasteners: Fasteners shall be protected from dirt and moisture at the job site. Only as many fasteners as are anticipated to be installed and tightened during a work shift shall be taken from protected storage. Fasteners not used shall be returned to protected storage at the end of the shift. Fasteners shall not be cleaned of lubricant that is present in as-delivered condition.
 - ii. Tension Calibrator: A tension measuring device shall be required at all job sites where bolts in slip-critical joints are being installed and tightened. The tension measuring device shall be used to confirm: (1) the suitability to satisfy the requirements of AISC for the complete fastener assembly, including lubrication if required to be used in the work, (2) calibration of wrenches, if applicable, and (3) the understanding and proper use by the bolting crew of the method to be used. The frequency of confirmation testing, the number of tests to be performed and

the test procedure shall be as specified in 1.d. below, as applicable. The accuracy of the tension measuring device shall be confirmed through calibration by an approved testing agency at least annually.

- iii. Joint Assembly and Tightening of Shear/Bearing Connections: Bolts in connections not within the slip-critical category shall be installed in properly aligned holes, but need only be tightened to the snug tight condition. The snug tight condition is defined as the tightness that exists when all plies in a joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. If a slotted hole occurs in an outer ply, a flat hardened washer or common plate washer shall be installed over the slot.
- iv. Joint Assembly and Tightening of Connections Requiring Full Pre-tensioning. Slip-critical connections shall be installed in properly aligned holes and tightened by one of the following methods.
 - 1) Turn-of-nut Tightening: When turn-of-nut tightening is used, hardened washers are not required except as specified in the AISC. A representative sample of not less than three bolts and nuts of each diameter, length and grade to be used in the work shall be checked at the start of work in a device capable of indicating bolt tension. The test shall demonstrate that the method of estimating the snug-tight condition and controlling turns from snug tight to be used by the bolting crews develops a tension not less than five percent greater than the tension required for slip-critical connections.
 - Installation of Alternate Design Bolts: A representative sample of not 2) less than three bolts of each diameter. length and grade shall be checked at the job site in a device capable of indicating bolt tension. The test assembly shall include flat hardened washers, if required in the actual connection, arranged as in the actual connections to be tensioned. The calibration test shall demonstrate that each bolt develops a tension not less than five percent greater than the tension required by AISC. Manufacturer's installation procedure shall be followed for installation of bolts in the calibration device and in all connections. When alternate design features of the fasteners involve an irreversible mechanism such as yield or twist-off of an element, bolts shall be installed in all holes of the connection and initially brought to a snug tight condition. All fasteners shall then be tightened, progressing systematically from the most rigid part of the connection to the free edges in a manner that will minimize relaxation of previously tightened fasteners prior to final twist-off or yielding of the control or indicator element of the individual fasteners. In some cases, proper tensioning of the bolts may require more than a single cycle of systematic tightening.
- v. Mark bolts that have been completely tightened with an identifying symbol.

3.02 WELDING

- A. General: Quality of materials and design and fabrication of all welded connections shall conform to AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Building," "AWS Code for Welding in Building Construction," and requirements of this section. Location and type of all welds shall be as shown. Make no other welded splices, except those shown on drawings, without prior approval of the architect.
- B. Automatic Welding: Use electrode wire and flux for automatic and semi-automatic welding acceptable to Structural Engineer. All methods, sequences, qualification and procedures, including preheating, and post heating if necessary, shall be detailed in writing and submitted to the Structural Engineer for review.

- C. Qualification of Welders:
 - 1. Structural steel welding: Manual and automatic welds for structural steel construction shall be made only by operators who have been previous qualified by tests, as prescribed in AWS D1.1 to perform type of work required.
 - 2. Welders shall be checked by welding inspector. Those not doing satisfactory work may be removed, and may be required to pass qualification tests again. All qualification testing shall be at the Contractor's expense.
 - 3. Only welders whose weld procedures and pre-qualification by testing that have passed shall be considered qualified for such welds.
- D. Control cooling process after weld is completed by either step down post heat or thermal blankets as determined by procedures and prequalification.
- E. Box columns and built-up members shall have ultrasonic testing before and after welding.
- F. Flame cut surfaces shall be ground to remove contaminated steel layer to provide welds proper fusion without impurities.
- G. Preparation of surface: Surfaces to be welded shall be free of loose scale, slag, rust, grease, paint, and any other foreign material.
- H. Welding equipment: Welding equipment to be used in each case shall be acceptable to welding inspector. Use equipment with suitable devices to regulate speed, and manually adjust operating amperage and voltage. The amperage capacity shall be sufficient to overcome line drop, and to give adequate welding heat.
- I. Remove runoff tabs and grind surfaces smooth where the tabs would interfere with fireproofing and architectural finishes.
- J. End-welded studs:
 - 1. Automatic end-welded studs: Automatically end-weld in accordance with the manufacturer's recommendations in such a manner as to provide complete fusion between the end of the stud and the plates. There shall be no porosity or evidence of lack of fusion between the welded end of the stud and the plate. The stud shall decrease in length during welding approximately 1/8 inch for 5/8 inch, and 3/16 inch for 3/4 inch diameter. Stud sizes indicated on drawings represent the finish stud height.
 - 2. Fillet-end welded studs: Studs may be welded using prequalified FCAW, GMAW, or SMAW processes provided the requirements of the AWS D1.1 Chapter 7 Section 7.5.5 are met as well as any other pertinent requirements of D1.1.
- K. Provide mill camber as shown on the construction documents within AISC tolerance. Place mill tolerance upward for all beams specified no camber.

3.03 ERECTION

- A. Structural steel erection: Comply with AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Building", latest edition.
- B. Erection Sequence: Erect steel in accordance with special erection sequences where special erection sequences are indicated on the contract documents.
- C. Before and during erection, keep all structural steel clean. Ship, handle and store steel in manner to avoid injury to members. Steel members showing evidence to rough handling or injury will be rejected.
- D. Mark each member with erection identification corresponding to mark shown on erection drawings. Carefully plan erection of structural steel so that no cutting and removal of material will be necessary. Do not torch burn in the field, unless specifically permitted by Engineer.
- E. Provide sufficient bracing, shoring and guys to effect safe and satisfactory erection. Provide

bracing and shoring capable of holding steel work plumb and properly aligned while field connections are being made, and until lateral force resisting elements are deemed by Architect capable of bracing structure. Temporary bracing shall be adequate to resist lateral forces from wind or seismic prior to the completion of the lateral resisting system.

- F. Set bearing and base plates with extreme care. Bring level, to line and grade with leveling plates or by leveling nuts and bolts. Grout solid under plates with a flowable non-shrink grout per Section 03 30 00 prior to applying vertical load.
- G. Field Assembly: Set structural framing accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces which will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

Shimming or other adjustments not indicated on drawings shall be approved by the Engineer prior to installation. Level and plumb individual members of the structure within specified AISC tolerances except as noted herein. Column shimming shall be 1/4 inch.

- H. All welds shall be full and clean, and conform to AISC and AWS specifications.
- I. Erection Tolerances: Individual pieces shall be erected so that the deviation from plumb, level and alignment shall not exceed 1 to 500 plus:
 - 1. The maximum displacement of the center line of columns adjacent to elevator shafts, from the established column line, shall not be more than 1 inch at any point.
 - 2. In order to provide a true, flat plane for the exterior elevations, install all steel framing at the exterior walls of the building, so that the center lines of such framing does not vary by more than 1 inch for the length of the building. Also install each vertical member on such grids so that its vertical center line does not vary by more than 1/2 inch from a vertical line for each story and 1 inch for its full height.
 - 3. All columns and beams shall adhere to Section M2.7 of the referenced "Specification for Structural Steel for Buildings" which states that completed members shall be free of twists, bends, and open joints. Take special care that column base plates are parallel and perpendicular to faces of columns and that bolt holes are accurately placed.
- J. Temporary Flooring:
 - 1. Provide planking and scaffolding necessary in connection with erection of structural steel, support of erection machinery, and construction materials. Temporary floors and use of steel shall be as required by applicable regulatory requirements.
 - 2. If steel decking is used as a working platform, it shall be temporarily tack-welded to supports to extent necessary for such use in accordance with applicable regulatory requirements. The concentrated loading from welding machines and other heavy machinery required for steel erection shall be distributed by planking or other approved means. Metal decking that becomes damaged as the result of being used as a working platform shall be replaced at no additional cost to the Owner.
- K. Tower Crane: The design for the support and bracing for a tower crane shall be the responsibility of the General Contractor. The design shall be prepared by a structural engineer licensed in the state of California. Drawings and calculations shall be stamped and signed by the structural engineer. Concentric, torsional, and/or eccentric loading to the main structure shall be resolved by the addition of structural steel for shear tabs, stiffeners, drag ties, bracing struts, etc., Such items shall be designed, detailed, furnished and installed by the contractor.

3.04 PAINTING AND CLEANING

A. Prior to prime coat application, clean all loose rust, mill scale, oil, dirt, and all other materials from all steel to be left exposed. Use hand tool, power tool, sandblasting, chemical cleaning, and any other method necessary to provide a smooth, sound surface for painting.

- B. Shop prime all steel except the following:
 - 1. Steel encased in concrete.
 - 2. Contact surfaces for slip-critical (sc) high strength bolts.
 - 3. Areas within 4 inches of field welds.
 - 4. Tops of members to receive metal decking.
 - 5. Steel to be fireproofed.
 - 6. Surfaces to be galvanized.
- C. Use the following Type A shop painting systems on all normal environment interior steelwork:
 - 1. Surface Preparation: SSPC-SP2 Hand Tool Cleaning or SSPC-SP3 Power Tool Cleaning. Where jobsite exposure is expected to exceed 6 months, SSPC-SP6 Commercial Blast Cleaning is required.
 - 2. Application: Follow coating manufacturer's printed directions.
 - 3. Material: Type A Tnemec Company, Inc., Series V10; Sherwin Williams Steel Spec Universal; Metal Case 94-231 Series or approved equal
 - 4. Number of Coats: One
 - 5. Dry Film Thickness: 2.0 mils minimum.
 - 6. Volume Solids: 56.0 +/- 2.0% minimum
 - 7. Generic Description: Modified Alkyd.
- D. Unless noted otherwise in subsection H, use the following Type B shop painting systems on all exterior steelwork and interior steelwork subjected to wet conditions or fumes (see subsection H for additional requirements)
 - 1. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning
 - 2. Application: Follow coating manufacturer's printed directions.
 - 3. Material: Type B Tnemec 90-97 Tneme-Zinc primer or approved equal
 - 4. Number of Coats: One
 - 5. Dry Film Thickness: 2.5 to 3.5 mils
 - 6. Volume Solids: 63% +/- 2%
 - 7. Generic Description: Zinc-Rich Urethane
- E. Unless noted otherwise in subsection H, use the following finish painting systems on all exterior steelwork and interior steel work subjected to wet conditions or fumes (see subsection H for additional requirements):
 - 1. Application: Follow coating manufacturer's printed directions. Apply over Type B primer system above.
 - 2. Material: Tnemec Series 750 UVX paint or approved equal
 - 3. Number of Coats: One
 - 4. Dry Film Thickness: 2.5 to 5 mils
 - 5. Volume Solids: 72% +/- 2%
 - 6. Generic Description: Polyfunctional Hybrid Polyurethane
- F. Primers and paints shall meet all federal and state environmental and air quality requirements.
- G. Apply two shop prime coats to areas which will be inaccessible after erection.

- H. All exterior steelwork and all interior steelwork subjected to wet conditions or fumes, including all welds, bolts, washers and other connection components, shall be primed and painted or hot-dip galvanized, as specified by the Architectural finish specifications. In the absence of Architectural finish specifications, all exterior steelwork and all interior steelwork subjected to wet conditions and fumes, including all welds, bolts, washers and other connection components, shall be hot-dip galvanized, conforming to the requirements set forth in ASTM A123/A123M and ASTM A153/A153M.
- I. Clean contact surfaces of high strength bolts of all burrs and material which might prevent solid seating of the parts. Steel to receive bolts shall be primer painted except beneath the contact area of slip-critical bolts.
- J. After erection, field touch up all welded areas, high strength bolts and damaged areas. For all steel to remain exposed, remove all blemishes, paint drips, and touch up prime coat.

3.05 HOISTING AND BRACING

- A. Provide all hoisting and erecting equipment and power.
- B. Provide and maintain any and all safety railings, toe boards, etc., required for the erection of steel framing and metal decking.
- C. Brace the erected frame in a manner which will assure safety and proper alignment to receive the metal decking and until the concrete slabs have been poured and have set.
- D. Erect building frame true and level. Erect columns in a manner to allow for movement due to welding shrinkage and thermal expansion and contraction of framing. Check plumbness after erection of each level. Maintain structural stability of frame during erection. Provide temporary bracing where necessary to maintain frame stability and to support required loads, including equipment and its operation.

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SECTION 05 12 24

WELDING OF MOMENT FRAMES

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Furnish materials and perform all labor necessary for the welding of Moment Resisting Frames. This includes both field and shop welding for the complete moment resisting joint.
- B. Welding:
 - All Welding shall be performed in full accordance with the latest edition of the AWS D1.1 Structural Welding Code-Steel, except as supplemented or modified by this specification. Reiteration or amplification of code provisions as contained in the specification shall not reduce the necessity of compliance with all other code requirements. All aspects of design, workmanship, technique, qualifications of welders, welding procedure specifications, and inspection shall comply with code requirements. The provisions of Clause 2 Part B, Specific Requirements for Design of Nontubular Connections (Statically or Cyclically Loaded), shall apply.
 - 2. Comply with provisions of AWS D1.8 and AISC 341 Chapter J.
- C. Related Work: Structural Steel, Section 05 12 00.

1.03 STANDARDS AND REFERENCES

- A. Standards and References: (Latest Edition unless specified otherwise)
 - 1. Reference Data:
 - i. If the year of the adoption or latest revision is omitted from the designation, it shall mean the specification, manual or test designation in effect the date the Notice to Proceed with the Work is given.
 - 2. American Welding Society
 - i. Structural Welding Code Steel (AWS D1.1)
 - ii. Structural Welding Code Seismic Supplement (AWS D1.8)
 - 3. American Institute of Steel Construction
 - i. Specification for Structural Steel for Buildings (AISC 360)
 - ii. Code of Standard Practice for Steel Buildings and Bridges (AISC 303)
 - iii. Seismic Provisions For Structural Steel Buildings (AISC 341)
 - iv. Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications (AISC 358)
 - 4. California Building Code (CBC).

1.04 QUALITY ASSURANCE

A. Welder Qualification:

- 1. All welders, welding operators, and tack welders shall be qualified by test and hold a current valid certificate issued by an independent testing agency, to perform the type of welds required by the work; including the process, position, and thickness of materials used (D1.1: Section 4).
- 2. In addition to meeting the requirements above, welders shall have experience and/or training to enable them to successfully make the welds required in the special moment resisting frames. Additional training for welders that are otherwise "qualified" may be necessary. Each contractor shall be responsible to ensure that all welders employed on the project have proper training and qualification testing consistent with the requirements of AWS D1.8 Section 5
- 3. All welders on the project shall be capable of understanding and following the requirements of the written WPS.
- 4. Each welder employed on the project shall understand all the requirements of this welding specification before welding on the project.
- B. Tests and Inspections:
 - 1. Provide special inspections and testing as described in the "Statement of Structural Special Inspections and Testing" within the structural drawings and as required by this section.
 - 2. A testing program is required prior to start of construction. Testing program to be done in Compliance with the CBC, AISC 360 and 341 requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.
 - 3. Inspections
 - i. Owner shall engage an independent testing and inspection agency. See Section 01 45 00
 - ii. Qualifications: All Inspectors shall meet the requirements of AWS D1.1, paragraph 6.1.4, AWS D1.8 Section 7.2, AISC 360 Section N4, and AISC 341 Section J4.
 - Inspection Agency Responsibility: The inspection agency shall perform all code required inspection including AWS D1.1 Section 6, AWS D1.8 Section 7, AISC 360 Section N5, AISC 341 Sections J5 through J9, and the requirements specified herein.
 - iv. In-Process Inspection: The Inspector is responsible for in-process inspection which includes the following:
 - 1) Inspect materials and equipment (D1.1: 6.2)
 - 2) Review WPS's (D1.1: 6.3)
 - 3) Review welder qualifications (D1.1: 6.4)
 - 4) Observe the joint preparation, assembly practice, welding technique, and performance of each welder (D1.1: 6.5.2)
 - 5) Inspect the final weld to ensure that it is of the proper size, length, and location (D1.1: 6.5.1)
 - 6) Confirm that the specific welding parameters employed are within the applicable limits of the written WPS (D1.1: 6.3.3)
 - 7) Inspect the weld to ensure it is crack free (D1.1: table 6.1)
 - 8) Inspect the weld to ensure that thorough fusion exists between layers of

weld metal and between the weld metal and base metal (D1.1: Table 6.1)

- 9) Ensure that all craters are filled to the complete cross-section of the weld (D1.1: Table 6.1)
- 10) Ensure that the weld profiles meet the geometric requirements (D1.1: 5.24)
- 11) Inspect the weld to ensure length meets the minimum requirements and any required corrections are made (D1.1: Table 6.1)
- 12) Inspect weld to ensure that any undercut does not exceed the limits of D1.1, Table 6.1
- 13) Inspect the weld to ensure that any porosity does not exceed the limits of D1.1 Table 6.1
- 14) The Inspector shall also ensure that all the requirements of this specification are met (D1.1: 6.1.4)
- 3. Testing
 - i. One hundred percent of complete joint penetration (CJP) groove welds shall be subject to ultrasonic testing (UT), and twenty five percent of complete joint penetration (CJP) beam-to-column groove welds shall be subject to magnetic particle testing (MT) per AWS D1.1, Section 6.10, 6.13 and AISC 341 Chapter J. All defective welds shall be repaired and retested with ultrasonic equipment at the Contractor's expense.
 - ii. The amount of MT testing on CJP groove welds is permitted to be reduced if the requirements of AISC 341 Chapter J, Section J6.2h are satisfied.
 - iii. Column Flanges: An area extending 6" above and below point where girder flanges are attached shall be inspected. Column flange edges shall be inspected visually, and entire area ultrasonically for lamination, plate discontinuities, and non-metallic inclusions.
 - iv. Ultrasonic inspections of CJP welds shall be conducted from both the top and bottom sides of the beam flange, and from the back side of the column flange as necessary to determine potential rejectable welding defects.
 - v. All weld tabs shall be removed. The affected area shall be ground smooth and magnetic particle tested for defects. (Dye penetrant may used where required).
 - vi. Where back-up bars are required to be removed, the weld root area shall be magnetic particle tested for defects.
 - vii. Base metal thicker than 1-1/2" loaded in tension in the through-thickness direction in tee and corner joints, where the connected material is greater than ³/₄" and contains CJP groove welds, shall be ultrasonically tested for discontinuities behind and adjacent to the fusion line of such welds per AISC 341 Chapter J, Section J6.2c.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.17 – Shop Drawings and Samples.

- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- C. Submittals: (Submit under provisions of Section 01 33 00)
 - 1. Fabricator and Erector Documents
 - i. Submit all documents required by AISC 360 Section N3.1 and AISC 341 Section J.2
 - 2. Quality Assurance (Testing) Agency Documents
 - i. Submit all documents required by AISC 341 Section J3.

1.07 DELIVERY, STORAGE AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- 1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Manufacturers of materials are listed to set a standard for design and product performances.
 - 2. Subject to the requirements of DIVISION 1, products of manufacturers not listed may be proposed for substitution, provided that they are equal in design, product performance and warranty to the products specified.
 - 3. The burden of proof of equality of proposed products is on the Contractor.

2.02 <u>MATERIALS</u>

- A. Electrodes:
 - 1. All electrodes used in moment frame connections shall provide a minimum charpy Vnotch (CVN) toughness of 20 ft-lbs at -20 ° F and 40 ft-lbs at 70 ° F in accordance with the appropriate AWS classification and AISC 341.
 - 2. For all self-shielded flux core arc welding (FCAW), use E70T7-K2, E70T-6, or E71T-8 electrodes for all flat and horizontal position welds. For welds other than flat or horizontal position, use E71T-8 electrodes. This shall include reinforcing fillet welds placed at the root of groove welds after back up bar removal and fillet welds connecting the shear tabs to the beam webs.
 - 3. For all shielded metal arc welding (SMAW), use E7018 electrodes for all welds.
 - 4. For flat and horizontal welds use 7/64" diameter electrodes maximum. For other welds use 5/64" diameter electrodes maximum.
 - 5. Electrodes, unless noted otherwise herein, shall be AWS A5.1 E70XX electrode minimum.
- B. Plates: ASTM A572 Grade 50 typical, ASTM A-36 where specified.

2.03 WELDING PROCESSES

- A. Prequalified Welding Processes At the contractor's option, SMAW, FCAW (gas-shielded and self shielded), GMAW (except shortcircuited transfer), and SAW may be used with prequalified welding procedure specifications (See 3.1). (D1.1: 3.2.1)
- B. Other Welding Processes ESW, EGW and GTAW may be used at the contractor's option, providing the welding procedure specifications are qualified by test. Other processes may be employed, subject to the Architect's approval. (D1.1: 3.2.2)

PART 3 - EXECUTION

3.01 WELDING PROCEDURE SPECIFICATION (WPS)

- A. All welding shall be performed in strict adherence to a written WPS, whether or not the WPS is prequalified or qualified by test.
- B. All WPS's shall be prepared by qualified individuals and the same individual responsible for the suitability of the WPS shall be recorded on the WPS.
- C. The written WPS shall be available to the welder, welding supervisor, and inspector.
- D. The welding machinery shall be equipped with suitable meters which are in proper working conditions to enable the welder to control the essential welding parameters listed in the WPS. (D1.1: 5.11) If the equipment is not so equipped, or if the instrumentation is not functioning, external measuring devices shall be used, provided they are available to all individuals as required for maintenance welding parameters.
- E. WPS's may be prequalified providing they meet all the requirements of AWS D1.1 Clause 3. Any deviation from the prequalified WPS requirements shall necessitate qualifications by test. (D1.1: 3.1)
- F. WPS's that are not prequalified shall be subject to the qualification testing specified in D1.1, Clause 4. For WPS's that have been qualified by test, the supporting procedure qualification record (PQR) shall be available to the welding supervisor and inspector upon their request. (D1.1: 4.7)

- G. The written WPS shall contain all the necessary information required by the code, this specification, and any other information necessary to produce welds that are in compliance with these requirements.
 - 1. The WPS shall list the applicable base metal types and thicknesses.
 - 2. The WPS shall contain a sketch of the joint and shall list the welding joint details, including type, weld type, joint geometry, and applicable dimensions. Individual weld passes shall be identified in the sketch and numbered to identify the maximum layer thickness and bead widths. In no case shall the layer thickness exceed 1/4", nor shall the maximum bead width exceed 5/8".
 - 3. The WPS shall list the applicable welding processes.
 - 4. The WPS shall list the filler metal specification and AWS classification, as well as details regarding shielding material used.
 - 5. The WPS shall indicate the minimum preheat requirements. The minimum specified preheat shall meet the requirements of D1.1, Table 3.2.
 - 6. The WPS shall list all applicable electrical characteristics for the process employed. The WPS shall clearly indicate the acceptable values required for each welding pass. These electrical characteristics shall include at a minimum the following:
 - i. Type of current, and acceptable ranges of current measured in amperage. For wire feed processes, at the contractor's option, wire feed speed may be listed in lieu of current.
 - ii. Voltage (for wire feed processes)
 - iii. Travel speed (range)
 - iv. Electrode extension for wire feed processes
 - v. Amperage, voltage and electrode extension (as applicable) shall be within the filler metal manufacturer's recommendation.
 - 7. The diameter of the electrodes specified on the WPS shall not exceed that indicated in this specification.
 - 8. The WPS shall indicate that each pass shall be completed in its entirety before subsequent passes are deposited.

3.02 FABRICATION

- A. Weld Access Holes: Weld access holes shall be adequately sized to ensure adequate access for welding and inspection (D1.1: 5.17). A minimum length from the toe of the weld preparation to the end of the hole is made. The height of the access hole shall be a minimum of the thickness of the material in which the hole is made, but in no case shall be less than 3/4". Shear tabs shall be sized to ensure the weld access hole region remains unobstructed. The radii of weld access holes shall be smooth and free of notches. Weld access holes for beam flange welds shall be in compliance with the requirements indicated on the drawings and AWS D1.8 Subclause 6.10.1.2.
- B. Assembly:
 - 1. Assembly tolerances shall not exceed those for the prequalified joint detail employed, or the limits of D1.1: 5.22, as applicable. The minimum root opening dimension shall be maintained for the length of the joint. For joints where the minimum root opening dimension is less than the minimum requirement, compensation may be made by increasing the root opening by gouging, chipping, or grinding. At the contractor's option, an alternate approved written WPS suitable for the smaller root opening may be employed. Root openings that exceed the maximum allowable may be corrected by welding to acceptable dimensions prior to joining the parts by welding. The Architect and Structural Engineer shall be notified when the root opening exceeds the allowable

tolerance range.

- 2. Bolts shall be fully torqued only after welds have been completed for both flanges. The fillet weld from beam web to shear tab shall be made after the bolts are fully torqued.
- C. Tack Welds:
 - 1. All tack welds shall be of the same quality as the final welds and shall be made with a qualified or prequalified WPS and by qualified personnel (D1.1: 5.18.1). This includes the requirements for preheat, unless the final weld is made by a submerged arc weld that remelts the single pass tack weld. (D1.1: 5.18.5).
- D. Peening:
 - 1. At the contractor's option, peening may be used on intermediate layers for control of shrinkage stresses to prevent cracking or distortion or both. No peening shall be done on the root pass or surface layers (D1.1: 5.27).
- E. Weld Cleaning:
 - 1. Before welding over previously deposited metal, all slag shall be removed from the weld and the adjacent base metal shall be brushed clean. The final weld layers shall be cleaned by brushing or other suitable means (D1.1: 5.30).
- F. Sequencing of Bottom Flange to Column Weld:
 - 1. Complete joint penetration (CJP) groove welds of beam bottom flanges to column flanges, or to continuity plates, using weld access holes shall be sequenced as follows (AWS D1.8, 6.14):
 - i. Weld starts and stops shall not be made directly under the beam web.
 - ii. Each layer shall be completed across the full width of the flange before beginning the next layer.
 - iii. For each layer, the weld starts and stops shall be on the opposite side of the beam web, as compared to the previous layer.
- G. Steel Backing:
 - 1. Groove welds made with the use of steel backing shall have the weld metal thoroughly fused with the backing (D1.1: 5.10.1)
 - 2. Steel backing shall be made continuous for the full length of the joint, and shall continue into the area of weld tabs. (D1.1: 5.10.2)
 - 3. Steel backing at beam flange to column flange joints shall not be welded to the underside of the beam flange. Tack welds are not permitted in this area (D1.8: 6.9.2).
 - 4. Steel backing on the bottom flange connection of special moment resisting frames shall be removed and proper treatment shall be given to the weld root (D1.8: 6.7). Unless detailed otherwise on the drawings, reinforcing fillet with a leg size of 5/16" minimum shall be applied (D1.8: 6.8). Where column flanges are being welded (i.e. column splices), both flanges shall receive this treatment.
- H. Weld Tabs:
 - 1. Weld tabs shall be employed to enable welds to be terminated at the end of the joint in a manner that will ensure sound welds (D1.1: 5.31.1). Weld tabs shall extend a minimum of 1" or thickness of the part, whichever is greater, beyond the edge of the joint. Weld tab length need not exceed 2" (D1.8: 6.11.1). The weld tabs shall substantially duplicate the groove weld profile.
 - 2. "End dams" that result in the application of auxiliary metal that is perpendicular to the longitudinal length of the weld shall not be used.

3. Weld tabs shall be removed upon completion and cooling of the weld unless noted otherwise on the drawings, and the ends of the weld shall be made smooth and flush with the edges of abutting parts. (D1.1: 5.31.3). Removal requirements shall be in compliance with AWS D1.8, subclause 6.11.3.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Shop fabricated metal items and miscellaneous metal work.
- B. Refer to Schedule at end of this Section.
- C. Related Work: Structural Steel, Section 05 12 00.

1.03 STANDARDS AND REFERENCES

- A. Standards and References: (Latest Edition unless otherwise noted)
 - 1. California Building Code (CBC)
 - 2. American Society for Testing and Materials (ASTM) Specifications as listed in the Section.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- C. Provide the following:
 - 1. Shop Drawings: Submit shop drawings indicating profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevation, and details where applicable. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.
 - 2. Manufacturer's descriptive data: Submit for manufacturer's items.

1.07 DELIVERY, STORAGE AND HANDLING

Provide in accordance with:

A. Project Manual Volume One, Sections 00710, Article 6.03 – Services, Materials and Equipment.

- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Deliver all parts ready for ready for erection; store in close proximity to final locations.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B.
- C. Steel Pipe: ASTM A53, Type E or S, Grade. B.
- D. Steel Bolts, Nuts, and Washers: ASTM A307.
- E. Welding Materials: AWS D1.1; type required for materials being welded.
- F. Galvanizing: Hot-dip process ASTM A123 typical and ASTM A153 for threaded fasteners performed after fabrication into largest practical section. Weight of coating not less than 2 oz. per sq. ft. of surface. Where damaged, repair surface with one coat of hot process galvanizing repair compound, "Galvalloy", Galvweldalloy", or approved equal.
- G. Primer: Tnemec Company "Series V10 Red Primer", Sherwin-Williams "Steel Spec Universal Primer"; or approved equal.
- H. Dissimilar Materials: Separate dissimilar surfaces in contact with or in close proximity to noncompatible metals, concrete masonry, or plaster with neoprene gasket; or other approved means.
- I. Expansion Bolts: Hilti "Kwik Bolt TZ" Expansion Anchor Bolts, galvanized unless otherwise indicated.

J. Non-shrink Grout: Master builders 928 or equal.

2.02 FABRICATION

- A. Verify dimensions on site prior to shop fabrication.
- B. Fabricate items with joints tightly fitted and secured.
- C. Fit and shop assemble in largest practical sections, for delivery to jobsite.
- D. Grind exposed welds flush and smooth adjacent finished surfaces. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.
- F. Make exposed joints butt tight, flush and hairline.
- G. Supply components required for anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, except where specifically noted otherwise.

2.03 <u>FINISH</u>

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact bond with concrete or where field welding is required.
- C. Prime paint interior items with one coat unless scheduled to be galvanized.
- D. Galvanize exterior items and scheduled interior items to minimum 2.00 oz/sq ft zinc coating.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Obtain Architect's approval prior to site cutting or making adjustments not scheduled.
- B. Clean and strip primed steel items to bare metal where site welding is scheduled.
- C. Make provision for erection loads with temporary bracing. Keep work in alignment.
- D. Supply items required to be cast into concrete with setting templates, for installation under appropriate Sections.

3.02 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Perform field welding in accordance with AWS D1.1.
- C. After installation, touch-up field welds, scratched or damaged surfaces with primer, except repair exposed galvanized work (not to be painted) with hot process field galvanizing, in accord with manufacturer's published directions.

3.03 SCHEDULE

- A. Provide and install items listed in Schedule and shown on Drawings with anchorage and attachment necessary for installation. The following Schedule lists principal items only. Refer to drawing details for items not specifically scheduled.
 - 1. Miscellaneous plates or angles not attached to structural steel; complete with anchorage for embedment.
 - 2. Exterior mounted ladders.
 - 3. Handrails and guardrails.

- 4. Bollards.
- 5. Gates for trash enclosure.

END OF SECTION

SECTION 05 51 33.13

METAL LADDERS

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all Metal Ladders, as shown on the Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Aluminum Fixed Vertical Ladders.

1.03 STANDARDS AND REFERENCES

- A. ANSI A14.3: Ladders Fixed Safety Requirements.
- B. OSHA 1910.23: Ladders.
- C. OSHA 1910.28: Duty to have fall protection and falling object protection.
- D. OSHA 1910.29: Fall protection systems and falling object protection-criteria and practices.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
- D. Shop Drawings for Ladders:
 - 1. Plan and section of ladder installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 – Services, Materials and Equipment.

- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Store products in manufacturer's unopened packaging until ready for installation.
- D. Store products until installation inside under cover. If stored outside, under a tarp or suitable cover.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.9 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 <u>WARRANTY</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Limited Warranty: Five years against defective material and workmanship, covering parts only, no labor or freight. Defective parts, if deemed so by the manufacturer, will be replaced at no charge, freight excluded, upon inspection at manufacturer's plant which warrants same.

PART 2 - PRODUCTS

2.01 <u>MANUFACTURERS</u>

- A. Basis of Design Manufacturer: Precision Ladders, LLC, which is located at: P. O. Box 2279 ; Morristown, TN 37816-2279; Toll Free Tel: 800-225-7814; Tel: 423-586-2265; Email: info@PrecisionLadders.com; Web: www.precisionladders.com
- B. Approved alternates: O'Keeffe's Inc. manufactured in Merced, CA; Alaco Ladder Company manufactured in Chino, CA; Or Architect approved equal.

2.02 ALUMINUM FIXED VERTICAL LADDER

- A. Aluminum Fixed Vertical Ladder and Components: Ladder, fall arrest system, walk-thru, side rails, cage, rest platforms, floor mounting brackets, security doors, security gates and finishes.
 - 1. Model: Model FL -*** (***= vertical height in inches) Aluminum Fixed Vertical Ladder as manufactured by Precision Ladders LLC.
 - 2. Capacity: Unit shall support a 1,500 lb (680 kg) loading without failure.
 - 3. Performance Standard: Units designed and manufactured to meet or exceed ANSI A14.3, OSHA 1910.23, OSHA 1910.28 and OSHA 1910.29.

- B. Components:
 - 1. Ladder Stringer: 2-1/2 inch by 1-1/16 inch by 1/8 inch (64 mm by 27 mm by 3 mm) extruded 6005-T5 aluminum channel. Pitch: 90 degrees.
 - 2. Ladder Tread: 2-1/4 inch by 3/4 inch by 1/4 inch (57 mm by 19 mm by 6 mm) extruded 6005-T5 aluminum with deeply serrated top surface.
 - 3. Ladder Mounting Bracket: 8-1/2 inch by 2 inch by 3 inch by 1/4 inch thick (216 mm by 51 mm by 76 mm by 6 mm) aluminum angle.
 - 4. Fall Arrest System: Complete system with rail, sleeves, and harness to limit any fall to 6 inches (152 mm). Removeable Post for Hatch Access Ladders with Fall Arrest System. Harness by others.
 - 5. Walk-Thru:
 - a. Hand Rails: 1-1/4 inch (32 mm) aluminum square tube with rounded edges.
 - b. Mounting Brackets: 4 inch by 4 inch by 1/4 inch (102 mm by 102 mm by 6 mm) aluminum.
 - c. Side Rails: 42 inch (1067 mm) side rail extension for through ladder exits.
 - 6. Safety Cage: Vertical and horizontal bars: 1/4 inch by 2 inch (6 mm by 51 mm) 6005-T5 aluminum flat bar.
 - 7. Rest Platform:
 - a. Bar grating.
 - b. Platform Size: 30" inches by 48 inches (762 mm by 1219 mm) standard.
 - c. Toe Boards. 6005 T-5 aluminum.
 - d. Handrails: 1-1/4 inch (32 mm) aluminum square tube 42 inches (1067 mm) high.
 - 8. Security Door: 0.125 inch (3 mm) 3003-H14 aluminum panel 84 inches (2134 mm) tall with padlock provision.
 - 9. Security Gate: Hinged gate at bottom of cage with padlock provision.
 - 10. Floor Brackets: Floor bracket at foot of each stringer, 3 by 2 by 1/4 inch (76 by 51 by 6 mm).
 - 11. Finishes:
 - a. Powder Coated
 - b. Color: Standard to be determined.

2.03 FABRICATION

A. Completely fabricate ladder ready for installation before shipment to the site.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- B. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

3.02 INSTALLATION

A. Install in accordance with approved submittals.

3.03 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Provide all labor, materials, tools, facilities and equipment required for the fabrication and installation of rough carpentry and associated items (except that which is specified elsewhere) indicated on Drawings and necessary to complete the Work. Items include, but are not necessarily limited to, the following:
 - 1. Blocking, backing, stripping, furring, and nailers.
 - 2. Rough hardware.
 - 3. Wood framing.
 - 4. Wood sheathing.
 - 5. Preservative treatment.
 - 6. Drilling, saw cuts, knock-outs and framing for ventilation.
 - 7. Wood sheathing backing at tile walls.

1.03 STANDARDS AND REFERENCES

- A. Standards and References: (Latest Edition unless otherwise noted)
 - 1. 2016 California Building Code (CBC).
 - 2. Lumber: West Coast Lumber Inspection Bureau (WCLIB); Standard Grading Rules for West Coast Lumber No. 17.
 - 3. Lumber: Western Wood Products Association (WWPA); Western Lumber Grading Rules 05.
 - 4. Redwood: Redwood Inspection Service (RIS); Standard Specifications for Grades of California Redwood Lumber.
 - 5. Wood Sheathing: The Engineered Wood Association; Specifications and Grades.
 - i. Structural Plywood: United States Product Standard PS1, Group 1 Douglas Fir.
 - ii. APA rated sheathing: United States Product Standard PS2.
 - 6. Wood Preservative: American Wood-Preservers' Association (AWPA):
 - i. U1, Use Category System: User Specification for Treated Wood.
 - ii. M4, Standard for the Care of Preservative-Treated Wood Products.
 - 7. 2015 National Design Specification for Wood Construction (NDS).

1.04 QUALITY ASSURANCE

- A. General:
 - 1. Coordinate the work of all trades to ensure proper placement of all materials, anchors,

etc., as well as providing for openings and anchors for the installation of surface mounted materials and equipment.

- 2. Qualifications for Workmen: Provide sufficient skilled workmen and supervisors who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of construction involved and the materials and techniques specified.
- 3. Rejection: In the acceptance or rejection of rough carpentry, no allowance will be made for lack of skill on the part of the workmen.
- B. Tests and Inspections:
 - 1. A testing program is required prior to start of construction. Testing program to be done in Compliance with the 2016 CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.
 - 2. If indicated on the Structural Drawings, load test expansion and epoxy anchors as indicated on the drawings.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- C. Provide the following:
 - 1. Certification:
 - i. Preservative Treated Wood: Certification for waterborne preservative and that moisture content was reduced to 19 percent maximum, after treatment.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Protection:
 - 1. After delivery, store all materials off the ground, covered, and in such a manner as to ensure proper ventilation and drainage and to protect against damage and the weather. Maintain wood at the maximum moisture levels indicated in Materials Section.
 - 2. Keep all material clearly identified with all grade marks legible; keep all damaged material clearly identified as damaged, and separately store to prevent its inadvertent use. Do not allow installation of damaged or otherwise non-complying material.
 - 3. Use all means necessary to protect the installed work and materials of all other trades.
 - 4. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.08 <u>OPERATION AND MAINTENANCE DATA</u> Not required.

- 1.09 <u>EXTRA MATERIALS</u> Not required.
- 1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 <u>MATERIALS</u>

- A. Sawn Lumber:
 - 1. Lumber (Wood Framing): Meet requirements of following minimum grades. All grades to WCLIB Grading Rules No. 17. Species shall be Douglas Fir Larch

<u>Item</u> All Material	<u>Sizes</u> 2x	<u>Grade</u> No. 2	Maximum Moisture <u>Content at Initial Use</u> 19%	<u>Notes</u> Unless Noted Otherwise
All Material	3x,4x	No. 2	30%	Unless Noted Otherwise
All Material Decking	6x 2x	No. 1 Select Dex	30% 19%	Unless Noted Otherwise

- 2. "At initial use" shall be that point at which nails, screws, bolts, split rings, shear plates or other fasteners or the holes for said fasteners are placed in the wood.
- 3. All sawn lumber is assumed to be enclosed in the dry building envelope in the final service condition, unless noted otherwise, and free to dry to moisture content less than 19%.
- 4. The Contractor shall use whatever means necessary, including site drying to ensure that the moisture contents above are not exceeded.
- 5. All studs, plates, joists, rafters and beams 3x and thicker shall be free of heart center in accordance with the specified grading standards.

B. Wood Sheathing:

- 1. Roof and Wall Structural Sheathing: PS1 and PS2 APA rated sheathing with exterior glue. Thickness type and grade shall be as indicated on Drawings.
- 2. Where indicated on the Architectural Drawings as interior wall backing behind tile and in all toilet rooms behind sheet rock, to be C-C APA rated sheathing with exterior glue. Thickness shall be 5/8-inch at all locations.

- 3. Flooring: C-C APA Performance rated tongue and groove with exterior glue. Thickness type and grade shall be as indicated on the Drawings.
- C. Building Paper: Fed. Spec. UU-B-790a, Type I, Grade B (15 lb. min. unless noted elsewhere.).
- D. Rough Hardware Fastenings and Connections: All types including bolts, lag screws, nails, spikes, screws, washers and other rough hardware, of kinds that may be purchased and that require no further fabrication, shall be furnished and installed for all finish and rough carpentry and shall conform to 2015 NDS Standards and dimensions. All hardware exposed to weather shall be hot-dipped galvanized per ASTM A153 Standards. All nails used into pressure treated lumber shall be hot-dipped galvanized per ASTM A153 or stainless steel.
 - 1. Common wire nails or spikes unless noted otherwise on the Drawings. Box nails and sinker nails are not permitted. Vinyl coating is permitted on nails when not exposed to weather.
 - 2. Bolts: Bolt material shall conform to ASTM A307, Grade A. Bolt dimensions shall conform to ANSI/ASME B18.2.1 with hex head of sizes indicated.
 - 3. Lag Screws: Lag screws shall conform to ASTM 307, Grade A. All lag screws shall have hex heads where exposed.
 - 4. Washers: Standard flat washers shall conform to ANSI B18.22.1, Type A, Wide Pattern. Steel plate washers shall be Simpson BP or BPS or equivalent. Malleable iron washers shall be standard malleable iron washers.
 - 5. Powder Driven Fasteners: Tempered steel pins with special corrosive resistant plating or coating. Pins shall have guide washers to accurately control penetration. Fastening shall be accomplished by low-velocity piston-driven power activated tool. Pins and tool shall be as manufactured by Hilti Fastening Systems or equivalent. See Drawings for size, type and embedment.
 - 6. Expansion Anchors: See Section 03 30 00 for anchors to concrete and Section 04 20 00 for anchors to masonry.
 - 7. Adhesive Anchors: See Section 03 30 00 for anchors to concrete and Section 04 20 00 for anchors to masonry.
 - 8. Fabricated Metal Timber Framing Connectors: Connectors shall be punched for nailing and bolting. Nails and nailing shall conform to the manufacturer's instructions with a nail provided for each punched hole. All connectors must have specific ICC approval. Types as noted on Drawings are Simpson Strong-Tie. Hardware suppliers other than Simpson shall submit a comparative material list itemizing product designation, load rating and supported member size for review by the enforcement agency and the Structural Engineer.

2.02 FABRICATION

A. Lumber:

- 1. All lumber shall be air or kiln-dried to the maximum moisture content indicated in Materials Section.
- 2. Furnish S4S unless otherwise noted.
- 3. Size to conform to rules of governing standard. Sizes shown are nominal unless otherwise noted.
- B. Wood Treatment:
 - 1. Preservative Treatment: The treating process and results thereof shall conform to the appropriate AWPA Standards for exterior, above ground use (3B) and as indicated in CBC Section 2303.1.9.
 - 2. After treatment and prior to shipping, air or kiln-dry lumber to maximum 19 percent

moisture content.

- 3. All treated wood shall be identified with a label meeting the requirements of CBC Section 2303.1.9.1.
- 4. The amount of preservative to be injected into the wood shall be as required by the AWPA standard for each type of installation.
- 5. All wood in contact with concrete or masonry shall be preservative treated.
- 6. Cut surfaces and bored holes in pressure treated wood shall be protected in accordance with AWPA Standard M4.
- C. Fire Treatment: All fire-retardant-treated wood shall be identified with a label meeting the requirements of CBC Section 2303.2.4. The treating process and results thereof shall meet the requirements of CBC Section 2303.2. Moisture content of fire-retardant-treated wood shall meet CBC Section 2303.2.8. Treater shall submit design and fastener valves for treated wood to Structural Engineer for review. See Drawings for location of fire-retardant-treated wood.

2.03 SOURCE QUALITY CONTROL

- A. Grade Mark each piece of lumber. Marking must be done by recognized agency.
 - 1. Douglas Fir shall bear WCLIB or WWPA grade stamp.
 - 2. Pressure treated Douglas Fir shall bear AWPA Quality mark.
- B. Wood Sheathing: Each panel shall be legibly identified as to type, grade and specie by APA grade. If plies are spliced, the slope of the scarf shall not be steeper than 1:8. White pockets will not be permitted in face plies.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly proceed.
 - 2. Verify that rough carpentry may be performed in strict accordance with the original design and all pertinent codes and regulations.
- B. Discrepancies: In the event of discrepancy, immediately notify Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 WORKMANSHIP

- A. General: All rough carpentry shall produce joints true, tight, and well nailed with all members assembled in accordance with the Drawings and with all pertinent codes and regulations.
- B. Selection of Lumber Pieces: Carefully select all members. Select individual pieces so that knots and obvious defects will not interfere with placing bolts or proper nailing or making proper connections. Cut out and discard all defects which will render a piece unable to serve its intended function.
- C. Lumber may be rejected by the Architect, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.
- D. Shimming: do not shim any framing component.
- E. Care shall be taken that notching and boring of members is in strict conformance with the Drawings and that there are no over-cuts.

3.03 FASTENING

- A. Nailing: Except as otherwise indicated on Drawings or specified, all nailing shall be as required by CBC Table 2304.10.1 Fastening Schedule.
 - Nails or Spikes shall be common wire unless noted otherwise. Penetration of nails or spikes shall be one-half the length of the nail or spike into the piece receiving the point. However, to connect pieces 2" in thickness, 16d nails shall be used unless noted otherwise.
 - i. Bore holes for nails wherever necessary to prevent splitting.
 - ii. Use finish or casing for finish work.
 - iii. Use of machine nailing is subject to a satisfactory installation of nails. Minimum edge distances shall be maintained. Nails installed through sheathing with nail guns shall not penetrate into the outer plies deeper than hand nailing. Submittal of guns and nails is required.
 - iv. All nailing into Pressure-Treated lumber shall utilize hot-dipped zinc coated galvanized nails or stainless steel nails per CBC Section 2304.10.5.
- B. Bolts and Lag Screws: Bolts shall be sizes indicated on Drawings. Holes for bolts shall be 1/16inch larger than the bolt diameter. Malleable, Steel plate or standard flat washers shall be used where heads or nuts would otherwise bear directly on wood surfaces. Malleable or plate washers shall be used on all anchor bolts. Cut washers are not permitted. Lag screws shall be screwed (not driven) into place. For the shank, holes shall be bored the same depth and diameter as shank. For threaded portion, holes shall be pre-drilled as follows:

Lag Screw Size	Thread Portion Pre-Drill	
1/2" diameter	1/4" diameter	
5/8" diameter	5/16" diameter	
3/4 diameter	3/8" diameter	
7/8" diameter	1/2" diameter	
1" diameter	5/8" diameter	

Soap Lag screws prior to installation. Tighten all bolts and screws before closing in.

C. Framing Devices: Install according to the manufacturer's instructions unless otherwise noted.

3.04 FRAMING AND ROUGH CARPENTRY

- A. Sills: Shall be in long lengths of sizes shown, fastened with anchor bolts as indicated, a minimum of two anchor bolts per piece. Place steel plate washers (but not standard flat or malleable iron washers) under nuts bearing on wood. Set sills level and true.
- B. Studs, Posts and Columns: Shall be full length. Corners shall be as detailed. Partitions or walls containing plumbing, heating or other piping shall be so formed as to give proper clearance for materials. Cut members as required to provide full bearing at ends. Connect to structure as indicated.
- C. Plates: Shall be full length of wall segment or 12-foot minimum and spliced as shown.
- D. Blocking: Blocking shall be same thickness and width of studs or joists unless shown otherwise. Blocking shall not be spaced over 8'-0" c.c. Install fire blocking in accordance with CBC. Horizontal fire blocking in walls shall be placed at floor lines and ceiling lines unless noted otherwise. Install blocking at all plywood joints where noted on the Drawings. Install wall width full height solid blocking at floor joists beneath all posts in walls. Blocking shall be installed around all wall, floor and roof penetrations.
- E. Joists and Beams: Shall be full span length and spliced over bearings unless shown otherwise. Install with crown side up. Beams or headers indicated to be built up of two or more joists shall be
fabricated on the job using full length members. For two piece 2x members, stitch nail pieces together with 16d common nails spaced not over 12 inches c.c. and staggered. Clinch nails protruding through members. For three or more piece members, stitch bolt pieces together with $\frac{1}{2}$ " bolts spaced not over 12 inches c.c. and staggered.

- 1. Provide double joists and headers at all openings through roof unless otherwise shown on Drawings.
- 2. Provide typical headers at all openings through walls where one or more studs are required to be cut. For penetration through walls narrower than stud spacing, provide solid blocking on all sides for fastening finish materials.
- F. Wood Sheathing: Install to pattern indicated and provide blocking at joints where noted on the Drawings. Center all joints over bearing supports. Nail to framing as indicated. Install wood sheathing with face plies perpendicular to joists unless indicated otherwise. Wall wood sheathing shall continue uninterrupted by ceilings or soffit from floor to floor or floor to roof unless specifically detailed on the Structural Drawings.
- G. Wood Furring, Stripping: Install as shown or required to provide nailing materials or passage of pipes, conduits, etc., not otherwise accommodated including ceiling stripping for gypsum drywall construction.
- H. Bridging: Space not over 8'-0" c.c. for spans over 16'-0". Joists 8 inches or less in depth shall not require bridging unless specifically indicated.
- Solid Wood Backing: Solid wood backing shall be provided for all wall and ceiling finishes and for supporting of mounted items for <u>all</u> trades, including but not limited to metal toilet partitions, toilet room accessories, frames, cabinets, casework, mirrors, trim, applied wall finishes, athletic equipment, food service equipment, piping, conduit, ducts, etc. Contractor shall coordinate placement of backing and supports with Subcontractor supplying mounted items.
- J. Building Paper: Install in all locations indicated except where included in other sections of the specifications.
- K. Cant Strips and Crickets: Shape to sizes shown. Rigidly fasten to construction. Form neat mitered corners.
- L. Wood Sheathing Backing: All toilet rooms, restrooms, single or joint occupancy shall have all walls backed with 5/8-inch thick wood sheathing with no surface voids. Install sheathing between the framing members and wallboard. The same wood sheathing shall also be provided and installed at all tile locations. At tile locations wood sheathing shall be installed between the framing members and the resin-cement backing board.

3.05 MISCELLANEOUS CARPENTRY WORK

- A. Install all items under other sections specified to be furnished and installed in other sections which relate to the rough carpentry work.
- B. Miscellaneous Carpentry Work not included under other sections but, indicated or required yet not specified elsewhere shall be furnished and installed hereunder, including appropriate fastening devices. Contractor shall provide miscellaneous carpentry work for all sections and divisions of work identified.
- C. Wood Curbs for Equipment: Construct all wood curbs for roof mounted equipment as detailed. Provide all miscellaneous blocking, bracing, supports, and other wood items as shown or required to complete the work.
- D. Plywood Backing for Electrical, telephone, and similar types of wall mounted equipment shall be provided hereunder where required. Plywood shall be 3/4-inch thick exterior A-C plywood with 'A' face exposed.
- E. Fire/Draft Stops: Construct fire and drafts stops in furred attic spaces where indicated or required by CBC code. Unless otherwise indicated on Drawings construct of not less than 5/8-inch Type 'X'

gypsum wallboard or ½" wood sheathing, adequately supported by 2x4's at 24 inches c.c., braced diagonally to the roof structure. Draft stop and installation work shall conform to code requirements.

- F. Shoring and Bracing: Shore or brace for temporary support of all work as required during the construction period except any shoring and bracing specified and included under other sections of these specifications.
- G. Temporary Enclosures: Provide and maintain all barricades and enclosures required to protect the work in progress.
- H. Protect all work in progress and all work installed, as well as the work of all other trades. Any work damaged as a result of the work under this section shall be corrected to its original condition or replaced if directed by the Architect at no increase in cost to the Owner.
- J. Ventilation: Contractor shall include all labor and materials necessary to provide ventilation requirements of roof overhangs, eaves, attics, and all other components of the building required by codes to be ventilated. Work shall include removing knock-outs in wood I-joists for cross ventilation, drilling of blocking, wood sheathing, and other wooden components of the structure necessary to comply with requirements of the CBC for ventilation of buildings.

SECTION 06 17 33 <u>WOOD I-JOISTS</u>

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Provide all labor, materials, tools, appliances, facilities and equipment required for the fabrication, delivery and erection of all Wood I-joists.
 - 1. All Wood I-Joists, joist blocking, bridging, etc., for the installation of joists.
 - 2. Clips, angles, straps, hangers, etc., incidental to installation of joists.
 - 3. Nails, bolts, washers and other fasteners used for erecting and securing of Wood I-joists.
- B. Related Work
 - 1. Structural Steel: Section 05 12 00.
 - 2. Rough Carpentry: Section 06 10 00.
 - 3. Glue-Laminated Construction: Section 06 18 00

1.03 STANDARDS AND REFERENCES

- A. Standards and References: (Latest Edition unless specified otherwise)
 - 1. 2016 California Building Code (CBC).
 - 2. ASTM D5055, "Structural Capacities of Prefabricated Wood I-Joists".

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. General Qualifications of Manufacturer: The fabricator shall have been engaged in the continuous manufacturing of Wood I-Joists for a minimum of five years.
- C. Tests and Inspections:
 - 1. A testing program is required prior to start of construction. Testing program to be done in Compliance with the 2016 CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.
 - 2. Manufacturing facility shall be approved by an independent inspection agency approved by the International Accreditation Service, Inc. (IAS).
 - 3. All joists shall bear a stamp indicating the plant number, independent inspection agency, logo and ICC ES Report number.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- C. Provide the following:
 - 1. Where indicated on Drawings, show erection plans, sizes, types and location of wood ljoists. Drawings shall also indicate sizes and location of blocking, hangers, etc., with sufficient detailing to ensure correct installation.
 - 2. Substantiation of Load Capacity by one of the following methods:
 - i. Structural calculations proving capacity to carry the loads shown on the drawings. Calculations shall be signed by a Professional Engineer registered in the State of California.
 - ii. Direct comparison of I-joists proposed and I-joists specified proving equal or better structural properties and direct comparison of hardware proposed and hardware specified proving equal or better capacities.
 - 3. ICC ES Report for supplied joist.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. If joists must be stored prior to erection, they shall be stored in a vertical position off the ground and covered and protected from weather.

1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 <u>WARRANTY</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 <u>MATERIALS</u>

- A. Wood I-Joists: Wood I-joists as indicated on drawings are Red Built or I-level designations and are for reference to indicate required depth, spacing and capacity only. Wood I-joists shall have specific ICC approval, and may be used only if equivalent, in the Architect's opinion, to Wood Ijoists specified. Structural capacities shall be evaluated by ASTM D-5055.
- B. Lumber:
 - 1. Wood Flanges: Laminated Veneer Lumber or Machine Stress Rated lumber. Species and thickness shall be such that the specified nailing capacity is not reduced.
 - 2. Wood Webs: U.S. Product Standard PS1 or PS2. Webs shall be constructed from Structural 1 plywood or OSB as indicated in manufacturer's ICC ES Report.
- C. Adhesive:
 - 1. According to manufacturer's ICC ES Report.
- D. Types:
 - 1. Sizes, properties and additional information as shown on the Drawings.
- E. Accessories to be furnished and installed as indicated on the Drawings are as follows:
 - 1. Blocking, hangers, brackets, straps, ties, etc., shown on Drawings.
 - 2. Miscellaneous accessories incidental to erection and installation of joists.

2.02 FABRICATION

- A. Fabrication shall be in compliance with manufacturer's ICC ES Report.
 - 1. Fabrication shall be in accordance with best practices with adequate plant equipment and under supervision of properly qualified personnel.
 - 2. Moisture content of components at time of gluing shall comply with the manufacturer's ICC ES Report.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Prior to installation of the work of this Section, carefully inspect and verify that the installed work of all other trades is complete to the point where this installation may properly commence.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. In the event of discrepancy, immediately notify Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.02 PROTECTION

- A. Protect work and materials of this Section during installation, and protect the installed work and materials of other trades.
- B. In the event of damage, make all repairs and replacement necessary to the approval of the Architect at no additional cost to the Owner.

3.03 HANDLING

A. Use equipment and methods that avoid damages that may impair strength of wood I-joists. Sharp instruments and unprotected wire rope, chain slings and the like shall not be permitted.

3.04 INSTALLATION

- A. Wood I-joists are to be erected and installed in accordance with the Drawings and manufacturer's recommendations. Comply with all manufacturer's recommendations concerning temporary construction loads.
- B. Erection bracing in addition to specified bridging is to be provided as detailed to keep the joist products straight and plumb as required and to assure adequate lateral support for the individual members and the entire system until the sheathing material has been applied.

3.05 <u>CLEANUP</u>

A. Keep premises free from accumulated waste materials, rubbish and debris resulting from this Work. Upon completion, remove tools, appliances, surplus materials, waste materials, rubbish, debris and accessory items used in or resulting from said Work, and legally dispose of off the site.

SECTION 06 18 00

GLUE-LAMINATED CONSTRUCTION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Provide all labor, materials, tools, appliances, facilities and equipment required for the fabrication and delivery to job site of all glued laminated wood members.
- B. Related Work:
 - 1. Rough Carpentry: Section 06 10 00.
 - 2. Wood I-Joists: Section 06 17 33.

1.03 STANDARDS AND REFERENCES

- A. Standards and References: (Latest Edition unless specified otherwise)
 - 1. 2016 California Building Code (CBC).
 - 2. 2015 National Design Specification for Wood Construction (NDS).
 - 3. American Institute of Timber Construction, "Standard Specifications for Structural Glued Laminated Timber of Softwood Species, AITC 117.
 - 4. ANSI/AITC Standard A190.1
 - 5. ASTM D3737 "Design and Manufacture of Structural Glued Laminated Timber".

1.04 QUALITY ASSURANCE

- A. General:
 - Qualifications of Manufacturer: The fabricator shall have been engaged in the continuous manufacturing of glued laminated timbers for a minimum of at least two years and shall have the authority to use the AITC "Quality Inspected Stamp". Each timber member shall be stamped and placed in such a position not to be visible on finished erected members.
- B. Tests and Inspections:
 - 1. A testing program is required prior to start of construction. Testing program to be done in Compliance with the 2016 CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.
 - 2. Each structural glued-laminated member shall be stamped with an identifying mark. Mark shall include all pertinent data, such as grade and species of lumber, type of glue, extremes of moisture content and other such information as may be required.
 - 3. Certificate of compliance with the above data.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITALLS</u>

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- C. Provide the following:
 - 1. Shop drawings showing full dimensions of each member and layout of entire structural system.
 - 2. Show large scale details of connections, connectors and other accessories.
 - 3. Indicate species and laminating combination, adhesive type, and other variables in required work.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Deliver undamaged products to site in manufacturer's protective wrappings with legends intact. Store on site secure from weather, soil and physical damage.
- D. Transport, handle and store in strict accordance with the manufacturer's recommendations. Use padded, non-marring slings.
- E. Architectural Appearance Grade members shall be shipped, handled and stored with complete weather and damage protection wrapping. Maintain wrappings in place until immediately prior to deck installation.
- F. Industrial Appearance Grade glued laminated timber members shall be wrapped in a water resistant covering during transit. Contractor shall be responsible for protection during hauling and unloading at job site.

1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.09 EXTRA MATERALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and

Guarantee.

C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 <u>MATERIALS</u>

- A. Lumber:
 - Lumber used for laminating structural members shall be well manufactured and shall conform to requirements of Standard Grading and Dressing Rules No. 17, West Coast Lumber Inspection Bureau. Such lumber shall be inspected, identified by individual piece, and certified as meeting requirements of said standard specifications by an approved lumber grading agency. It is assumed that each lamination is graded on basis of requirement for nominal size of individual lamination. When lumber is resawn, it shall be regraded on basis of new size.
- B. Type: Glued Laminated Timber Protected from Weather
 - 1. Species: Douglas Fir or Western Larch
 - 2. Stress Grade: AITC Combination 24F-V4 for simple beams, 24F-V8 for cantilever or continuous beams.
 - 3. Extreme fiber bending F_b = 2400 psi
 - 4. Adhesives: Wet use
 - 5. Appearance Grade: AITC Industrial for concealed uses, Architectural appearance at exposed uses.
 - 6. Preservative Treatment: Portions of beams exposed to weather shall be preservative treated.
 - 7. Laminations: Provide outer tension laminations or proof load testing as required by ANSI/AITC A190.1.
 - 8. Sealing: Shop seal all surfaces with 2 coats of clear penetrating sealer.
- C. Type: Glued Laminated Timber Exposed to Weather
 - 1. Species: Alaskan Yellow Cedar
 - 2. Stress Grade: AITC Combination 20F-V12 for simple beams, 20F-V13 for cantilever or continuous beams.
 - 3. Extreme fiber bending F_b = 2000 psi
 - 4. Adhesives: Wet use
 - 5. Appearance Grade: Architectural
 - 6. Laminations: Provide outer tension laminations or proof load testing as required by ANSI/AITC A190.1.
 - 7. Sealing: Shop seal all surfaces with 2 coats of clear penetrating sealer.

2.02 FABRICATION

- A. Fabrication shall be in compliance with the above standards and references.
 - 1. Fabrication shall be in accordance with best practices with adequate plant and equipment and under supervision of properly qualified personnel.
 - 2. Laminations shall be machine finished to a smooth surface, but not sanded, and to a uniform thickness with a maximum allowable variation of 1/64 inch. Warp, twist, or other

characteristics which will prevent intimate contact of adjacent glued faces or interfere with uniform bending to a required curvature when under clamping pressure shall not be permitted. Surfaces to be glued shall be clean and free from oil, dust and other foreign material which would be detrimental to satisfactory gluing.

- 3. Moisture content of lumber at time of gluing shall be not less than 7 percent nor more than 12 percent.
- 4. Slips, misses, and wane are not permitted.
- 5. Boring of holes in members shall be in strict conformance with the Drawings. Notching is prohibited except where specifically detailed.
- 6. Field cuts and holes in preservative treated members shall be preservative treated and sealed.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Prior to installation of the work of this Section, carefully inspect and verify that the installed work of all other trades is complete to the point where this installation may properly commence.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. In the event of a discrepancy, immediately notify Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.02 PROTECTION

- A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.
- B. In the event of damage, make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

3.03 HANDLING

A. Use equipment and methods that avoid scarring corners and faces or otherwise injuring members. Sharp instruments and unprotected wire rope, chain slings and the like shall not be permitted.

3.04 INSTALLATION

A. Glued Laminated members are to be erected and installed in accordance with the Drawings and manufacturer's recommendations.

3.05 <u>CLEANUP</u>

A. Keep premises free from accumulated waste materials, rubbish and debris resulting from this work. Upon completion, remove tools, appliances, surplus materials, waste materials, rubbish, debris and accessory items used in or resulting from said Work, and legally dispose of off the site.

SECTION 06 20 00

FINISH CARPENTRY

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install complete Finish Carpentry Work as shown on Drawings and as specified herein. Provide hardware and attachment accessories as required for a complete and proper installation.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

- A. Verify all dimensions shown on Drawings by taking field measurements; proper fit and attachment of all parts is required.
- B. Following standards apply to Work of this Section except where more stringent requirements are specified herein:
 - 1. Architectural Woodwork Institute "Quality Standards".
 - 2. Western Wood Products Association Manual.
 - 3. American Wood Preservers Association Specifications.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Submit shop drawings of millwork at full size or large scale showing sizes, materials, grain run, methods of construction, connection to adjacent members and installation. Indicate all backing members for installations and all hardware

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Douglas Fir: West Coast Lumber Inspection Bureau "Standard Grading and Dressing Rules" and Western Wood Products Association, graded "C" and better, flat grain grade marked by WCLIB or WWPA.
- B. Douglas Fir Plywood: U.S. Product Standard PS-1, American Plywood Association, grade trademarked "C-D", plugged, exterior glue, sanded.
- C. Blocking, Furring, etc.: Standard Grade Western White Pine, Construction grade Douglas Fir or other equally sound softwood, as graded by WCLIB or WWPA.
- D. Softwood Lumber: PS 20; custom grade in accordance with AWI maximum moisture content of 6%; of quality capable of transparent finish.
- E. Hardwood Lumber: FS MM-L-736; custom grade in accordance with AWI; maximum moisture content of 6% of quality capable of transparent finish.

2.02 ACCESSORIES

- A. Nails, bolts, nuts, washers, blind fasteners, lags and screws, size and type to suit application.
- B. Wood Filler: oil base, tinted to match surface finish color.
- C. Shelf Standards and Rests: Knape and Vogt #255 & #256 for recessed application. Provide two hold down clips for each shelf in the slot above
- D. Closet Hanger Bars and Supports: Knape and Vogt #770, #660, #734, #735, and #1195. Provide intermediate support of spans over 6'-0".

2.03 SHOP TREATMENT OF WOOD MATERIALS

A. Shop pressure treat wood materials requiring UL fire rating or preservations.

Provide UL approved identification on fire retardant treated material.

- B. Wood Preservative (PT type) Wolmanized, Pressure Treated Lumber, manufactured by Osmose Wood Products or approved equal.
- C. Fire Retardant (FR-S Type) chemically treated, and pressure impregnated, capable of providing a maximum rating of 25; manufactured by Demose Wood Products. Dricon FRT or approved equal.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that surfaces and openings are ready to receive work and field measurements are as shown on Shop Drawings and instructed by the fabricator.
- C. Verify that mechanical, electrical, and building items affecting work of this Section are placed and ready to receive this work.
- D. Correct conditions detrimental to timely and proper completion of the Work.
- E. Do not proceed until unsatisfactory conditions are corrected.
- F. Beginning of installation means acceptance of conditions.

3.02 PRIMING

Back paint all wood surfaces inaccessible and unexposed after installation before delivery with an approved linseed oil and aluminum primer.

- A. Prime coat all unfinished metal parts.
- B. Prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.03 FINISH CARPENTRY INSTALLATION

- A. Use only hot dip galvanized or aluminum finish or casting nails. Set nails for putty stopping in surface members. Hammer marks not acceptable on any exposed finished surface and may be cause rejection of Work by Architect.
- B. Make all end splices exposed in finished members bevel splices and not square butted. Install members in as long lengths as possible.
- C. Install Work to details shown, plumb, level and to line and securely anchored per AWI custom quality standard. Make scribes where required accurate. Miter corners of trim.
- D. Provide and install other miscellaneous millwork items and related Work required to complete Work of this Section.
- E. Prepare all woodwork installed hereunder by cleaning and sanding as required to receive finishes specified in Section "Painting and Finishing".
- F. Install all doors and frames; finish hardware and bathroom accessories per manufacturer's recommendation.
- G. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth and site finish.

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SECTION 01 64 10

ARCHITECTURAL CASEWORK

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all Architectural Casework, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete and proper installation.
- B. Section Includes:
 - 1. Plastic laminate casework
 - 2. Plastic laminate countertops
 - 3. Solid surface countertops
 - 4. Hardware typically furnished by the casework manufacturer
 - 5. Shelving
 - 6. Structural supports incorporated into wood casework
- C. Excluding:
 - 1. Metal support brackets and fittings that are part of the building structure
 - 2. Plumbing, electrical fixtures, and telephone equipment
- D. Related sections:
 - 1. Rough carpentry: Wood blocking or grounds inside finished walls or above finished ceilings
 - 2. Plumbing: Fixtures and fittings installed in countertops
- 1.03 STANDARDS AND REFERENCES
 - A. The North American Architectural Woodwork Standards (NAAWS), latest edition. Jointly published by Woodwork Institute and the Architectural Woodwork Manufacturers Association of Canada.
 - B. NEMA LD-3, High Pressure Decorative Laminate, latest edition
 - C. ANSI 208.1, Particle Board, latest edition
 - D. ANSI 208.2, MDF, latest edition

1.04 QUALITY ASSURANCE

- A. Work shall be in accordance with the Grade or Grades specified of the *North American Architectural Woodwork Standards*.
- B. Certified Compliance Program (CCP):
 - 1. Before delivery to the job site, provide a Woodwork Institute Certified Compliance Certificate indicating the millwork and countertop products being supplied and

certifying that these products fully meet the requirements of the *NAAWS* Grade or Grades specified.

- 2. Provide a Woodwork Institute Certified Compliance Label on each countertop and elevation of casework.
- 3. At completion of installation provide a Woodwork Institute Certified Compliance Certificate indicating the products installed, and certifying that the installation of these products fully meets the requirements of the *NAAWS* Grade or Grades specified.
- 4. All fees charged by the Woodwork Institute for its Certified Compliance program are the responsibility of the millwork manufacturer and/or installer and shall be included in their bid.
- C. Qualification:
 - 1. A Woodwork Institute Accredited Millwork Company in good standing
 - 2. Firm (woodwork and countertop manufacturer) with no less than five years of production experience similar to a specific project, whose qualifications indicate the ability to comply with the requirements of this section.
 - 3. The woodwork manufacturer must have at least one project in the past five years where the value of the woodwork was within 20 percent of the cost of woodwork for this project.
- D. Single source responsibility: A single manufacturer shall provide and install the work of described in this section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Shop drawings:
 - 1. Submit shop drawings in conformance with the requirements of the *North American Architectural Woodwork Standards*.
 - 2. Furnish a Woodwork Institute Certified Compliance Label on the first page of the shop drawings.
 - 3. Submit two copies, one of which will be returned with reviewed notations. Make corrections noted (if any), and distribute required copies prior to the start of work.
- B. Samples:
 - 1. Submit four finished samples of each species and cut of wood to be used. Lumber samples to be minimum 6 inches by 18 inches, and sheet product samples to be minimum 12 inches square. Samples shall represent the range of color and grain expected to be provided.
 - 2. Submit four unfinished samples of each product to be provided for job-site painting or finishing. Lumber samples to be minimum 6 inches by 18 inches, and sheet goods to be 12 inches square.

3. Submit a sample of each plastic laminate, and/or solid surface color and pattern to be used.

1.07 DELIVERY STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Coordinate fabrication, delivery, and installation with the general contractor and other applicable trades.
- D. Deliver materials only when the project is ready for installation and the general contractor has provided a clean storage area.
 - 1. Delivery of architectural millwork shall be made only when the area of operation is enclosed, all plaster and concrete work is dry and the area broom clean.
 - 2. Maintain indoor temperature and humidity within the range recommended by the *North American Architectural Woodwork Standards* for the location of the project.

1.08 OPERATION AND MAINTENANACE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 <u>WARRANTY</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 MILLWORK COMPONENTS

A. Lumber: In accordance with the *North American Architectural Woodwork Standards* Grade specified for the product being fabricated. Moisture Content: 6% to 12% for boards up to 2-inch (50.8 mm) nominal thickness, and shall not exceed 19% for thicker pieces.

- B. Core:
 - 1. Particleboard meeting the requirements of *North American Architectural Woodwork Standards*.
 - a. Water-resistant core, where required: Particle board meeting the requirements of ANSI A208.1 Grade M3 MR-50
- C. Veneer core plywood: A non-telegraphing hardwood manufactured with exterior glue.
- D. Plastic laminate: Meeting the requirements of the *North American Architectural Woodwork Standards* for its use.
 - 1. High pressure laminated plastic conforming to NEMA LP-3, 0.50" thickness for tops and 0.028" thickness for vertical surfaces.
 - 2. Cabinet interiors: Low Pressure Melamine
 - 3. Backing sheet: LD-3-BK 20 backing grade undecorated plastic laminate.
- E. Edgeband: High-pressure decorative laminate of the same pattern and color as the exposed surfaces.
- F. Hardboard: PS-58, pressed wood fiber with resin binder, tempered grade, smooth two sides for drawer bottoms.
- G. Adhesives: Type II, water-resistant typical. Type I, fully waterproof at sink tops and sink cabinets.
- H. Hardware:
 - 1. Finish: Satin aluminum unless noted otherwise.
 - 2. Pulls: Amerock BP76312-G10 or Architect approved equal.
 - 3. Drawer guides for Drawers 24" wide or less: 100-pound capacity, full extension, ball bearing. Accuride 3832 or Architect approved equal.
 - 4. Drawer guides for File, Paper Storage and Heavy Duty Drawers 42" wide or less: 150-pound capacity, over travel extension, ball bearing. Accuride 4043 or Architect approved equal.
 - 5. Hinges: Concealed, European style, self-closing, Grade II hinges minimum 120 degree opening.
 - 6. Shelf supports: Knape & Vogt KV 255 or Architect approved equal.
 - 7. Shelf clips: Knape & Vogt KV 256 or Architect approved equal.
 - 8. Locks: Provide on all doors and drawers unless noted otherwise in Drawings.
 - a. Door locks: Olympus Door Lock 100 series or Architect approved equal.
 - b. Drawer locks: Olympus Door Lock 200 series with re-keying feature or Architect approved equal.
 - c. Keying: Keyed alike
 - 1. Provide 2 keys per lock.
 - 2. Provide 4 master keys.
 - 9. Miscellaneous Accessories: Provide grommet(s) as indicated in the Drawings.

2.02 MILLWORK FABRICATION

A. Grade: NAAWS Custom Grade.

- B. Exposed exterior surfaces: High-pressure decorative laminate. Color and pattern as indicated in the Drawings.
- C. Exposed (open cases) and semi-exposed (behind doors) interior surfaces: White melamine.
- D. Cabinet construction type: Frameless.
- E. Door Interface Style: Flush overlay
- F. Edgebanding at all exposed and semi-exposed edges including doors, drawer fronts and false fronts: High-pressure laminate of the same color and pattern as the exposed surfaces.
- G. Shelves: Adjustable shelves to be 1" thick.
- H. Drawers:
 - 1. Face and back: Plastic laminate face cabinet liner back. Laminate to plywood total thickness 3/4". Band all four edges with matching High Pressure Laminate.
 - 2. Sides: 1/2" Particle board with melamine surfacing
 - 3. Bottoms: 1/4" Hardboard
 - 4. Joinery: Dowels

2.03 COUNTERTOPS

- A. Grade: *NAAWS* Custom Grade
- B. Plastic Laminate
 - 1. Flat countertops: NEMA LD-3 Grade HGS. 0.048" thick.
 - 2. Formed countertops: NEMA LD-3 Grade HGP. 0.039" thick.
 - 3. Manufacturer, Pattern, Color: As indicated in the Drawings.
 - 4. Core: 3/4" Particleboard, composed of wood chips and waterproof resin binders.
 - 5. Backsplash detail: Cove, 4" high minimum
 - 6. Front edge: No-drip bullnose edge
 - 7. Cutouts: Seal edges of cutouts in sink countertops with a color-toned (for verification) water-resistant sealer before sinks are installed.
- C. Solid Surface
 - 1. Manufacturer, Pattern, Color: As indicated in the Drawings
 - 2. Backsplash detail: Cove, 4" high minimum.
 - 3. Front edge: No-drip bullnose edge

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the Work.
- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Beginning of installation means acceptance of conditions.
- E. Verify that surfaces and openings are ready to receive work and field measurements are as shown on Shop Drawings and instructed by the fabricator. Verify dimensions for work of other trades incorporated into the casework.

- F. Verify the adequacy and proper location of any required backing or support framing.
- G. Verify that mechanical, electrical, plumbing, and other building components affecting work in this section are in place and ready.

3.02 INSTALLATION

- A. Install all work in conformance with the *North American Architectural Woodwork Standards*, latest edition.
 - 1. Installation shall conform to the NAAWS grade of the items being installed.
- B. All work shall be secured in place, square, plumb, and level.
- C. All work abutting other building components shall be properly scribed.
- D. Mechanical fasteners used at exposed and semi-exposed surfaces, excluding installation attachment screws and those securing cabinets end to end, shall be countersunk.
- E. Equipment cutouts shown on plans shall be cut by the installer.

3.03 ADJUSTING AND TOUCH UP

- A. Before completing installation, the installer shall adjust all moving and operating parts to function smoothly and correctly.
- B. All nicks, chips, and scratches in the finish shall be filled and retouched. Damaged items that cannot be repaired shall be replaced.

3.04 <u>CLEANUP</u>

A. Upon completion of installation, the installer shall clean all installed items of pencil and ink marks and broom clean the area of operation, depositing debris in containers provided by the general contractor.

SECTION 06 60 00

PLASTIC FABRICATIONS

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Provide factory-finished Surface Materials and similar items where shown on the drawings, as specified herein, and as needed for a complete and proper installation. Work may include, but is not limited to:
 - 1. Standard Decorative Laminates.
 - 2. Solid Surfacing.

1.03 STANDARDS AND REFERENCES

- A. ASTM D 638 Standard Test Method for Tensile Properties of Plastics.
- B. ASTM G 21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- C. ISO 4586-2 High Pressure Decorative Laminates; International Organization for Standardization.

1.04 <u>QUALITY ASSURANCE</u>

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Samples:
 - 1. Selection Samples: Submit actual samples of surfacing materials to illustrate full range of colors, patterns, and finishes available.
 - 2. Verification Samples: Submit two samples, each 12 inches square; illustrating each selected surfacing material in specified color, pattern, and finish.
- D. Manufacturer's Instructions:
 - 3. Submit manufacturer's printed installation instructions for each product.
 - 4. Submit manufacturer's Safety Data Sheets (M.S.D.S.) for each adhesive.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 STANDARD DECORATIVE LAMINATES

- A. Acceptable Products: As indicated on the Drawings or Architect approved equal.
- B. Product Description: Decorative surface papers, impregnated with melamine resins, bonded under heat and pressure to kraft papers impregnated with phenolic resins.
- C. Standard Decorative Laminate General Purpose Type: having the following physical characteristics:
 - 1. Sheet thickness: 0.048-inch (1.219 mm) plus/minus 0.005-inch (0.127 mm).
 - 2. Exceeding performance requirements of NEMA LD 3-1995 Grade HGS.
 - 3. Surface burning characteristics in accordance with ASTM E 84; unbonded: Flame spread 55; Smoke developed 30.
 - 4. Patterns and Finishes: Selected from manufacturer's full range of available selections, as selected and approved by Architect.

2.02 SOLID SURFACING MATERIAL

- A. Acceptable Product: As indicated on the Drawings.
- B. Product Description: Homogenous sheet material composed of acrylic resins, fire-retardant filler materials, and coloring agents.
 - 1. Nominal sheet thickness: 0.50 inch (13 mm).

- 2. Surface burning characteristics in accordance with ASTM E 84: Flame spread less than 25; Smoke developed less than 25.
- 3. Liquid Absorption, ISO 4586-2, for 1/2-inch material thickness: 0.4 percent after 2 hours boiling water.
- C. Izod Impact, ASTM D 256, Method A: 0.2 foot pounds per inch.
 - 1. Tensile Modulus, ASTM D 638 Nominal: 1.7 million pounds per square inch.
 - 2. Thermal Expansion, ASTM D 696: 0.000019-inch per inch per degree F, maximum.
 - 3. Hardness, ASTM D 2583, Barcol Impressor: 59.
 - 4. Flexural Modulus, ASTM D 790: 1.6 million pounds per square inch.
 - 5. Deflection Temperature under load, ASTM D 648: 90 degrees C.
 - 6. Stain Resistance: ANSI Z124.6 modified, Method 3.4: No effect.
 - 7. Boiling Water Resistance, NEMA LD 3-1995, Method 3.5: No effect.
 - 8. High Temperature Resistance: NEMA LD 3-1995, Method 3.6: No effect.
 - 9. Radiant Heat Resistance: NEMA LD 3-1995, Method 3.10: No effect.
 - 10. Light Resistance: NEMA LD 3-1995, Method 3.3: No effect.
 - 11. Ball Impact Resistance, NEMA LD 3-1995, Method 3.8, one half pound ball, unsupported: 125 inches.
 - 12. Specific Gravity: 0.977 ounces per cubic inch (1.69 grams per cubic centimeter).
 - 13. Approximate weight: 4.2 pounds per square foot (20.5 kg/square m).
 - 14. Weatherability: ASTM D 2565: Pass.
 - 15. Fungus Resistance, ASTM G 21: Pass.
 - 16. Bacterial Resistance, ASTM G 22: Pass.
 - 17. Pittsburgh Protocol Toxicity: 66.9 grams.
 - 18. Patterns and Finishes: Selected from manufacturer's full range of available selections, selected and approved by Architect.
 - 19. Impact Resistance NEMA LD3-1995 (1/2 lb. Ball) SSV bonded to substrate*** Method 3.08 modified. 125" (No Failure)
 - 20. Tensile Toughness ASTM D 638. 21 (in. lb./in. ³)
 - 21. Tensile Modulus ASTM D 638 Nominal. 1.7 x 10⁻⁵ lb./in.³
 - 22. Density 1.60 gram/cm³
 - 23. Approximate weight 4.2 lbs./ft²
 - 24. Pittsburgh Protocol Toxicity = 30 grams range

PART 3 – EXECUTION

- 3.01 EXAMINATION
 - A. Examine the areas and conditions under which work of this Section will be performed.
 - B. Verify that specified items may be installed in accordance with the approved design.
 - C. Correct conditions detrimental to timely and proper completion of the Work.
 - D. Do not proceed until unsatisfactory conditions are corrected.

E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

Surface preparation: Precondition surfacing materials and surfaces to receive surfacing materials in accordance with manufacturer's printed installation instructions.

3.03 <u>APPLICATION</u>

Install materials in accordance with manufacturer's printed instructions.

SECTION 06 71 13

STRUCTURAL COMPOSITE LUMBER

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Provide all labor, materials, tools, appliances, facilities and equipment required for the fabrication, delivery and erection of all Structural Composite Lumber (SCL).
 - 1. All blocking, bridging, etc., for the installation of members.
 - 2. Clips, angles, straps, hangers, etc., incidental to installation of members.
 - 3. Nails, bolts, washers and other fasteners used for erecting and securing members.
- B. Related Work
 - 1. Rough Carpentry: Section 06 10 00.
 - 2. Wood I-Joints: Section 06 17 33.
 - 3. Glue-Laminated Construction: Section 06 18 00.

1.03 STANDARDS AND REFERENCES

- A. Standards and References: (Latest Edition unless specified otherwise)
 - 1. 2016 California Building Code (CBC)

1.04 QUALITY ASSURANCE

- A. General Qualifications of Manufacturer: The fabricator shall have been engaged in the continuous manufacturing of SCL members for a minimum of five years.
- B. Tests and Inspections:
 - A testing program is required prior to start of construction. Testing program to be done in Compliance with the 2016 CBC requirements and in collaboration with Testing Laboratory, Design team, contractor, owner and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.
 - 2. Manufacturing facility shall be approved by an independent inspection agency approved by the International Accreditation Service, Inc. (IAS).
 - 3. All members shall bear a stamp indicating the grade, plant number, independent inspection agency, logo and ICC ES report number.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- C. Submittals: (Submit under provisions of Section 01 33 00).
 - 1. Show erection plans, sizes, types and location of SCL members. Drawings shall also indicate sizes and location of blocking, hangers, etc., with sufficient detailing to ensure correct installation.
 - 2. Product Data substantiating compliance with material properties shown on the Drawings.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. If members must be stored prior to erection, they shall be stored in a vertical position off the ground, covered and protected from weather.

1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 <u>MATERIALS</u>

- A. Structural Composite Lumber (SCL): SCL members shall be of the types and sizes indicated on Drawings and as specified here. Structural composite lumber shall have specific ICC approval, and shall meet all specified structural design properties. Proposed SCL members may be used only if equivalent, in the Architect's opinion, to the SCL specified.
- B. Lumber
 - 1. Laminated Veneer Lumber (LVL): LVL shall be manufactured in accordance with the manufacturer's ICC-ES Report and have properties equal to or greater than as specified on the Drawings. Lumber species, thickness, etc. shall be such that the nailing capacity is equal to or better than that specified.

- 2. Parallel Strand Lumber (PSL): PSL shall be manufactured in accordance with the manufacturer's ICC-ES Report and have properties equal to or greater than as specified on the Drawings. Lumber species, thickness, etc. shall be such that the nailing capacity is equal to or better than that specified.
- 3. Laminated Strand Lumber (LSL): LSL shall be manufactured in accordance with the manufacturer's ICC-ES Report and have properties equal to or greater than as specified on the Drawings. Lumber species, thickness, etc. shall be such that the nailing capacity is equal to or better than that specified.
- 4. Various SCL products shall only be used where specifically indicated on the Drawings. No substitutions shall be made without written approval.
- C. Adhesive:
 - 1. According to manufacturer's ICC ES Report.
- D. Types:
 - 1. Sizes, properties and additional information as shown on the Drawings.
- E. Accessories to be furnished and installed as indicated on the Drawings are as follows:
 - 1. Blocking, hangers, brackets, straps, ties, etc., shown on Drawings.
 - 2. Miscellaneous accessories incidental to erection and installation of members.

2.02 FABRICATION

- A. Fabrication shall be in compliance with manufacturer's ICC ES Report.
 - 1. Fabrication shall be in accordance with best practices with adequate plant equipment and under supervision of properly qualified personnel.
 - 2. Moisture content of components at time of gluing shall comply with the manufacturer's ICC ES Report.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Prior to installation of the work of this Section, carefully inspect and verify that the installed work of all other trades is complete to the point where this installation may properly commence.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. In the event of discrepancy, immediately notify Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.02 PROTECTION

- A. Protect work and materials of this Section during installation, and protect the installed work and materials of other trades.
- B. In the event of damage, make all repairs and replacement necessary to the approval of the Architect at no additional cost to the Owner.

3.03 <u>HANDLING</u>

A. Use equipment and methods that avoid damages that may impair strength of SCL members. Sharp instruments and unprotected wire rope, chain slings and the like shall not be permitted.

3.04 INSTALLATION

A. SCL members are to be erected and installed in accordance with the Drawings and manufacturer's recommendations.

3.05 <u>CLEANUP</u>

A. Keep premises free from accumulated waste materials, rubbish and debris resulting from this Work. Upon completion, remove tools, appliances, surplus materials, waste materials, rubbish, debris and accessory items used in or resulting from said Work, and legally dispose of off the site.

SECTION 06 83 16

FIBERGLASS REINFORCED PANELING

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Work included: Provide sanitary wall and ceiling panels and trim where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related Work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Special Conditions, and Sections in Division 1 of these Specifications.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Manufacturer's Specifications and other data needed to prove compliance with the specified requirements;
 - 2. Samples of the full range of colors and patterns available from the proposed manufacturer in the specified range; if substituting product / color selected.
 - 3. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures for the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 – Services, Materials and Equipment.

- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Deliver pre-finished panels in undamaged condition as packaged by the manufacturer, in sealed, labeled containers.
- D. Store panels in a cool, clean, and dry storage area off the ground. Maintain storage area temperature above 45° F with normal humidity.
- E. Temperatures:
 - 1. Install pre-finished panels only when normal temperatures and humidity conditions approximate the same conditions that will exist when building is occupied.
 - 2. Maintain areas to receive pre-finished panels at a minimum temperature of 65° F measured at floor level.
 - 3. Maintain minimum temperature for 72 hours before, during, and 48 hours after applications of wall coverings.
- F. Temperatures:
 - 1. Install pre-finished panels only when normal temperatures and humidity conditions approximate the same conditions that will exist when building is occupied.
 - 2. Maintain areas to receive pre-finished panels at a minimum temperature of 65° F measured at floor level.
 - 3. Maintain minimum temperature for 72 hours before, during, and 48 hours after applications of wall coverings.
- G. Ventilation:

Provide adequate continuous ventilation as required for the various wall coverings, sealers and adhesives used in the spaces scheduled, but in no case, for a time less than that recommended by the manufacturer for full drying or curing.

1.08 OPERATION AND MAINTENANCE DATA

- A. Provide in accordance with Project Manual Volume One, Article 6.12 Record Documents.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Provide in accordance with Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- D. Maintenance Instructions:
 - 1. Furnish a copy of the vinyl-coated fabric manufacturer's maintenance instructions at project's Final Completion.
 - 2. Include recommended cleaning materials and methods of application therefor together with precautions in cleaning materials' use if such are improperly applied.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 <u>WARRANTY</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 FIBERGLASS REINFORCED PANELS (FRP)

- A. Basis of Design: Nudo Products, Fiber-Lite Liner Panel, Class A, Pebbled finish or approved equal.
- B. Approved alternates: Crane Composites, Marlite, or Architect approved equal.
- C. Provide fiberglass reinforced plastic panels complying with ASTM D5319.
- D. Colors as indicated on the drawings or will be selected by the Architect.
- E. Performance Criteria:
 - 1. Scratch Resistance: ASTM d2583
 - 2. Abrasion Resistance: Taber Abrasion Test using CS-17 abrasive wheels with 1000g weight. Panels shall exhibit weight loss after 25 cycles of no more than 0.038%.
 - 3. Impact Strength: ASTM D5420 showing no visible damage on finish side.
- F. Accessories:
 - 1. Moldings, Trim and Caps: One-piece extruded polypropylene or PVC, configured to cover panel edges and corners. Color as selected by Architect from manufacturer's full product range.
 - 2. Adhesive: As recommended by panel manufacturer for the required substrates.
 - 3. Sealants: A single-component, mildew-resistant silicone as recommended by panel manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the Work.
- C. Ascertain that substrates are straight within a maximum tolerance of 1/8 inch in 10 feet, and not greater than 1/16 inch in one foot.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Coordinate work with other trades as needed to assure that proper substrate are provided to receive work of this Section.
- F. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

A. Clean substrates to remove substances that could impair bond of adhesive, including oil,

grease, dirt, dust or other contamination.

- B. Condition panels by unpacking and placing in installation space no less than 24 hours before installation.
- C. Lay out paneling before beginning installation. Locate panel joints to provide equal panel widths at ends of walls and so that trimmed panels at corners are not less than 12 inches wide.

3.03 INSTALLATION

- A. General: Comply with panel manufacturer's Installation Guide #6876.
- B. Cut and drill panels with carbide tipped saw blades or drill bits, or cut with snips.
- C. Install panels with manufacturer's recommended gap for panel field and corner joints. Pre-drill fastener holes in panels, 1/8" greater in diameter than fastener. Install panels in a full spread of adhesive. For trowel type and application of adhesive, follow adhesive manufacturer's recommendations.
- D. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.
- E. Sealant: Fill grooves in trim accessories with sealant before installing panels and be inside corner trim in a bead of sealant. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths.

3.04 <u>CLEANING</u>

- A. Remove temporary coverings and protection of adjacent work areas.
- B. Repair or replace any installed products that have been damaged.
- C. Clean installed panels in accordance with manufacturer's instructions prior to Owner's acceptance.
- D. Remove and lawfully dispose of construction debris from project site.

SECTION 07 05 00

CONCRETE FLOOR TESTING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Administrative and procedural requirements for testing interior concrete slabs for moisture vapor emission rate, alkalinity, and temperature and humidity.
- B. Testing shall be conducted by the Owner's Testing Agency.

1.03 STANDARDS AND REFERENCES

- A. ASTM F-1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride.
- B. ASTM F-710 Standard Practice for Preparing Concrete Floors and other Monolithic Floors to receive Resilient Flooring.
- C. ASTM F-2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

1.04 QUALITY ASSURANCE

- A. Owner Responsibilities: Owner will engage a qualified testing agency to perform testing indicated.
 - 1. Owner will furnish Construction Manager with name, address, and telephone number of testing agency.
 - 2. Payment for testing services will be made by the Owner directly to the testing agency.
 - a. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be paid by the Owner and charged to Contractor by an adjustment to the Contract Sum through a Change Order.
- B. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken.
 - 3. Perform tests and submit a certified written report of each test, inspection, and similar quality-control service to Owner, Architect, Construction Manager and Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 5. Do not perform any duties of Contractor.
- C. Contractor Responsibilities: Coordinate sequence of activities to accommodate required testing services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

- 1. Schedule times for tests, inspections, obtaining samples, and similar activities. Notify agency sufficiently in advance of operations to permit assignment of personnel.
- 2. Acclimate enclosed spaces to the anticipated occupied temperature and humidity as required by the manufacturer of the specified flooring material(s) and in accordance with ASTM testing requirements.
- 3. Cooperate with agencies performing required tests and inspections, provide reasonable auxiliary services as requested. Provide the following:
 - a. Access to the Work.
 - b. Incidental labor and facilities necessary to facilitate tests and inspections.
 - c. Security and protection for testing and inspecting equipment at Project site.
- 4. Project Meeting: Schedule and conduct project meeting not less than 30 days prior to flooring installation to discuss testing requirements, specifications and locations prior to testing. Attendees shall include Owner, Architect, Construction Manager, Contractor, Testing Agency, and adhered floor installer representatives.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Reports: Reports of results of all testing shall be submitted by the Owner's Testing Agency. Reports shall include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. For each test provide a record of interior temperature, humidity, moisture vapor emission, in-concrete relative humidity and alkalinity results for testing period.
 - 8. Test and inspection results and an interpretation of test results.
 - 9. Provide on the Architectural Floor Plan(s) as furnished by the Architect a test number identifying each test conducted.
 - 10. Name and signature of laboratory inspector.
 - 11. Recommendations on retesting and re-inspecting.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA Not required.

- 1.09 EXTRA MATERIALS Not required.
- 1.10 <u>RECORD DRAWINGS</u>

Not required.

1.11 <u>WARRANTY</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment to be provided by Testing Agency.
- B. American Moisture Test, Inc., Website: americanmoisturetest.com, Tel: (866) 670-9700.
 - 1. ASTM F1869 Moisture Vapor Emission Test kits
 - 2. ASTM F-2170 In-Concrete Relative Humidity Testing System
 - 3. ASTM F-710 Alkalinity-pH wide range 1 14pH meter

PART 3 - EXECUTION

3.01 EXAMINATION

Site: Weatherproofed, doors installed and windows secured. Do not start testing process when site has standing water, surface contaminants, exposed to exterior conditions or concrete installation is less than 90 days of age.

3.02 PREPARATION

- A. Contractor Responsibilities:
 - 1. Preparation of Substrates:
 - a. Prepare concrete substrates according to ASTM requirements.
 - b. Verify that substrates are dry and free of curing compounds, sealers, and hardeners for vapor emission testing per ASTM F-1869.
 - c. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - Temperature and Humidity: Maintain site at the temperature and humidity conditions to those anticipated during normal occupancy and maintain these conditions 48 hours prior and during testing period. If meeting this criteria is not possible, then minimum conditions should be 75± 10°F and 50± 10% relative humidity.
 - a. When a building is not under HVAC control, record temperature and humidity at start and end of testing using a portable data logging system.

3.03 <u>TESTING</u>

- A. Testing: Testing Agency shall perform tests as follows:
 - 1. Water vapor emission testing, ASTM F 1869.
 - a. Perform all gram scale weights on site.
 - b. Expose dome for 60 to 72 hours.
 - c. Report results as pounds of emission per 24 hours per ASTM F-1869.
 - d. Perform subfloor moisture testing in accordance with the Manufacturer's requirements for each floor system type. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained
 - 2. In-Concrete Relative humidity testing, ASTM F 2170.
 - a. Satisfactory results shall have a maximum 75 percent relative humidity level measurement.
 - 3. Alkalinity Testing:
 - a. Apply neutral-pH solution to form a 1-inch diameter circle directly to interior of moisture dome.
 - b. Allow to absorb into concrete for 1 minute.
 - c. Apply flat tip pH meter to solution and document result as required by manufacturer.
 - d. Perform pH tests on concrete floors regardless of their age or grade level in accordance with the Manufacturer's requirements for each floor system type. PH level shall not exceed range of the Manufacturer's requirements for each floor system type. All test results shall be documented and retained
- B. Adhered floor coverings shall not be installed in areas where satisfactory test results have not been obtained.
- C. Consult Architect on remedial measures to reduce concrete levels prior to installing flooring. Installation of flooring deems acceptance of on-site conditions for a warranted application.

3.04 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
- B. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."
- C. Protect construction exposed by or for quality-control service activities.
- D. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.
SECTION 07 21 00

THERMAL INSULATION

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install Thermal Insulation, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. The principal items of work include:
 - 1. Thermal Insulation within roof.
 - 2. Thermal Insulation within exterior walls.
 - 3. Thermal Insulation within interior walls.
 - 4. Thermal Insulation for below concrete slabs-on-grade.

1.03 STANDARDS AND REFERENCES

- A. American Society for Testing of Materials (ASTM):
 - 1. ASTM C 518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 2. ASTM C 578: Standard Specification for Rigid Cellular Polystyrene Thermal Insulation.
 - 3. ASTM C 612: Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - 4, ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 5. ASTM E 96: Standard Test Methods for Water Vapor Transmission of Materials.
 - 6. ASTM E 119: Standard Test Methods for Fire Tests of Building Constructions and Materials.
- B. NFPA 285: Standard Fire Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load Bearing Wall Assemblies Containing Combustible Components.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Upon completion of this portion of the Work, complete and post a certificate of insulation compliance in accordance with pertinent requirements of governmental agencies having jurisdiction.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

A. Project Manual Volume One, Section 00710, Article 6.05 – Substitutes and "Or-Equals".

B. Project Manual Volume One, Section 00800, SC-6.05 - Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

1.07 DELIVERY, STORAGE AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide in accordance with Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Contractor Guarantee: Contractor guarantees the work covered by this specification against all defects in material and workmanship for a period of not less than two (2) years from the date the Owner records Notice of Completion.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Provide thermal insulation as indicated on Drawings. Insulation shall comply with ASTM Testing Standards and local Energy Codes. Fire Hazard Classification, Flame Spread Index, Smoke Developed Index, Combustibility, and Fire Endurance Ratings as required by Code.
- B. Insulation shall be as manufactured by Certain-Teed, Johns-Manville, Owens-Corning, or Architect approved equal.

2.02 BATT INSULATION MATERIALS

- A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used at Contractor's option.
- B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665, friction fit.
 - 1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 2. Flame Spread/Smoke Developed: 25/50 or less in accordance with ASTM E84.
 - 3. Basis-of-Design:
 - a. Owens Corning Corp: EcoTouch Pink Fiberglass Insulation
 - b. Recycled Content: minimum 55%
 - c. Certified Formaldehyde Free
 - d. Indoor Air Quality: Certified GreenGuard Gold
- C. Mineral Wool Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665, friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
 - 1. Combustibility: Non-combustible when tested in accordance with ASTM E136.
 - 2. Basis-of-Design:
 - a. Owens Corning Corp: Thermafiber Insulation
 - b. Recycled Content: minimum 70%
 - c. Indoor Air Quality: Must meet or exceed standards established per California Department of Public Health Section 01350.

2.03 CONTINUOUS INSULATION MATERIALS

- A. Provide continuous insulation as indicated on Drawings.
- B. Rigid Polystyrene Board: ASTM C 578 Type IV Classification.
 - 1. Basis-of-Design: Owens Corning Corp: Foamular 250 XPS Insulation
 - a. Thermal Resistance @ 75°F: R-5
 - b. Thermal Resistance @ 40°F: R-5.4
 - c. Water Absorption after 24 hrs submergence per ASTM C 272: 0.10%
 - d. Surface Burning Characteristics per ASTM E 84: Flame Spread >25; Smoke Developed >450
 - e. Compressive Strength: 25 psi minimum
 - f. Recycled Content: 20% minimum

- C. Mineral Wool Board: ASTM C 612 Types IA, IB, II, III, IVA.
 - 1. Basis-of-Design: Owens Corning Corp: Thermafiber Continuous Insulation Rain Barrier
 - a. Thermal Resistance @ 75°F: R-4.2
 - b. Combustibility: Non-combustible when tested in accordance to ASTM E 136.
 - c. Surface Burning Characteristics per ASTM E 84: Flame Spread 0, Smoke Developed 0.
 - d. Compressive Strength: Type IA, IB, IVA @ 4.5 pcf; Type II, III @ 6 pcf
 - e. Recycled Content: 70% minimum
 - f. Insulation Retaining Clips: Thermafiber RainBarrier Clips

2.04 CURTAIN WALL INSULATION

- A. Where indicated, provide mineral wool insulation at the densities required. At gaps between perimeter edge of fire-resistant rated floor assemblies and non-fire-resistant exterior curtain walls, provide perimeter fire-containment system with the fire test response characteristics indicated as determined by testing per Underwriters Laboratories or Intertek (OPL) Laboratories.
 - 1. Basis-of-Design: Owens Corning Corp: Thermafiber FireSpan 90 & Thermafiber FireSpan 40 Insulation.
 - a. Thermal Resistance @ 75°F: R-4.2
 - b. Facing: Unfaced/Foil Facing as per drawings.
 - c. Density: FireSpan 90 @ 8 pcf (nominal); FireSpan 40 @ 4 pcf (nominal)
 - d. Surface Burning Characteristics per ASTM E 84: Flame Spread 0, Smoke Developed 0; Foil Faced material: Flame Spread 25, Smoke Developed 0.
 - e. Recycled Content: minimum 70%
 - 2. Safing Insulation
 - a. Basis-of-Design: Owens Corning Corp: Thermafiber Safing Insulation
 - b. Thermal Resistance @ 75°F: R-4.2
 - c. Facing: Unfaced/Foil Facing as per drawings.
 - d. Density: as per fire test
 - e. Surface Burning Characteristics per ASTM E 84: Flame Spread 0, Smoke Developed 0; Foil Faced material Flame Spread 25, Smoke Developed 0.
 - f. Recycled Content: minimum 70%
 - 3. Accessories
 - a. Safing Clips: Z-shaped galvanized steel clips
 - b. Hardware: Thermafiber Impasse hardware for attaching curtain insulation
 - 1. Mechanical fasteners as approved by Architect and Manufacturer
 - c. Mullion covers
 - 1. 1-inch Thermafiber FireSpan 90 Insulation for protection of mullions.
 - 2. 2-inch Thermafiber FireSpan 90 Insulation for protection of mullions.
 - d. Backer/Reinforcement Member: Thermafiber Impasse T-Bar or other light gauge steel channel or angle approved by manufacturer. Place horizontally at

the safe-off line to support the curtain wall insulation to prevent bowing of curtain wall insulation caused by compression fitting of the safing insulation.

- e. Smoke Barrier: Smoke sealant as listed in the appropriate fire tested assembly and approved by the Architect and Manufacturer.
- f. Vapor Retarder Tape: Compatible with specified facer and comparable to perm rating. For taping insulation joints and repairing tears.

2.05 CONCRETE SLAB ON GRADE INSULATION

- A. Provide homogenous, hydrophobic extruded polystyrene rigid insulation board with compressive strength and thickness to meet foundation Ultimate Loads.
 - 1. Basis-of-Design: Owens Corning Corp: Foamular XPS 250/400/600/1000
 - a. ASTM C578 Types and minimum Compressive Strengths:

Foamular 250: Type IV, 25 psi Foamular 400: Type VI, 40 psi Foamular 600: Type VII, 60 psi Foamular 1000: Type V, 100 psi

- b. Thermal Resistance @ 75°F: R-5 per inch
- c. Thermal Resistance @ 40°F: R-5.4 per inch
- d. Water absorption after 24 hrs submergence per ASTM C272: 0.05%
- e. Water vapor permeance per ASTM E 96: 1.1 maximum perms
- f. Indoor Air Quality: Meet GreenGuard Gold Certification

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the Work.
- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

- A. Verify adjacent materials are dry and ready to receive installation.
- B. Verify mechanical and electrical services within walls have been installed and tested.

3.03 INSPECTION

- A. Before any installation is started, determine that the other work is suitable to receive insulation.
- B. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
- C. Remove or protect against projections in construction framing that may damage or prevent proper insulation.

3.04 INSTALLATION

- A. All work shall be performed by licensed applicators, shall comply with the recommendations of the manufacturer and the National Association of Insulation Manufacturers.
- B. Install insulation with factory applied membrane facing warm side of building spaces. Lap ends and side flanges of membrane over and between framing numbers. Secure in place. Tape seal butt ends and lapped side flanges. Tape seal tears or cuts in membrane.
- C. Trim insulation neatly to fit spaces. Use batts free of damage. Install batt insulation, in wall spaces without gaps or voids.
- D. Install Insulation in all indicated walls from floor to underside of roof. Secure batt insulation with 19-gage wire or 1" wide, 20 gage steel strips. Architect shall approve all insulation details, including methods of fastening, before commencement of the work.

3.05 CLEAN UP AND DISPOSAL

At frequent intervals during and again upon completion of work, remove from building and working premises tools and equipment, surplus materials, all rubbish and debris of whatever nature not caused by other trades, and leave the work in a clean, orderly and acceptable condition approved by the Architect.

END OF SECTION

SECTION 07 25 00

WEATHER BARRIER

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all Weather Barriers, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete and proper installation.
- B. Section includes products for weather barrier assemblies:
 - 1. Commercial weather barrier assemblies.
 - 2. Self-adhered, butyl based flexible flashing.
 - 3. Self-adhered, butyl based weather barrier flashing.
 - 4. Weather barrier accessories.
 - 5. Drainage material.
- C. Related Sections:
 - 1. Section 04 22 00 "Concrete Unit Masonry" for masonry ties and flashing installation.
 - 2. Section 07 21 00 "Thermal Insulation" for installation of exterior insulation.

1.03 STANDARDS AND REFERENCES

- A. Comply with the Industry Standards and References as established by the Manufacturer.
- B. Definitions
 - 1. Weather Barrier: A combination of materials and accessories that attain the following:
 - a. Prevents the accumulation of water as a water-resistive barrier.
 - b. Minimizes the air leakage into or out of the building envelope as a continuous air barrier.
 - c. Provides sufficient water vapor transmission to enable drying as a vaporpermeable membrane.
 - 2. Water-Resistive Barrier: Materials and accessories that prevent the accumulation of water within the wall assembly per California Building Code Section 1403.2.
 - 3. Continuous Air Barrier: The combination of interconnected materials, assemblies, and sealed joints and components of the building envelope that minimize air leakage into or out of the building envelope per ASHRAE 90.1 section 5.4.3.1.
 - 4. Vapor Diffusion: A slow movement of individual water vapor molecules from regions of higher to lower water vapor concentration (higher to lower vapor pressure).
 - 5. Vapor Permeable Membrane: The property of having a water-vapor permeance rating of 10 perms (575 ng/Pa x s x sq. m) or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E 96 per definition in International Building Code. Vapor permeable material permits the passage of moisture vapor through vapor diffusion.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is certified by weather barrier system manufacturer to install manufacturer's product.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Utilize exterior wall assembly, 10 feet by 10 feet, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of weather barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Include junction with roofing membrane building corner condition, and foundation wall intersection, fenestration and wall interface.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Manufacturer's Field Service: Register project with weather barrier manufacturer prior to installation of weather barrier and comply with weather barrier manufacturer's Project registration and observation process.
- D. Pre-installation Conference
 - 1. Two weeks prior to start of weather barrier installation, conduct pre-installation conference. Include Owner, Architect, Manufacturer's Certified Installer, weather barrier manufacturer's designated field representative, and installers of work that interfaces with or affects weather barrier.
 - 2. Review methods and procedures related to weather barrier installation, including manufacturer's written instructions.
 - 3. Review and finalize construction, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine substrate conditions and finishes for compliance with requirements.
 - 5. Review flashings, special weather barrier details, weather barrier penetrations, and condition of other construction that affects weather barrier.
 - 6. Review weather barrier manufacturer's Project Registration and Observation process.
 - 7. Review temporary protection requirements for weather barrier during and after installation.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.

- C. Action Submittals
 - 1. Product Data: For each type of product.
 - a. For weather barrier, include data on air and water-vapor permeance based on testing in accordance with referenced standards.
 - 2. Shop Drawings: Show details of weather barrier at terminations, openings, and penetrations. Show details of flexible flashing applications.
- D. Informational Submittals
 - 1. Evaluation Reports: For weather barrier and flexible flashing, from ICC-ES.
 - 2. Manufacturer's Instructions: For installation of each product specified.
 - 3. Qualification Data: For Installer and field testing agency.
 - 4. Sample Warranty: For manufacturer's warranty.
 - 5. Reports: Field test and inspection reports.
 - 6. Installer's weather barrier manufacturer-training certificate.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Do not store near heat source or open flame.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

- 1.11 WARRANTY
 - A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
 - B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
 - C. Provide in accordance with Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
 - D. Manufacturer's Product Warranty: To repair or replace weather barrier product that fails in materials within specified warranty period.
 - 1. Warranty Period: 10 years from date of purchase.

- E. Manufacturer's Product and Labor Warranty: Manufacturer agrees to repair or replace weather barrier that fails in materials within specified warranty period, including removal and replacement of affected construction up to manufacturer's limits.
 - 1. Warranty Period: 10 years from date of purchase.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Products as manufactured by DuPont Safety & Construction: E. I. du Pont de Nemours and Company.
- B. Or Architect approved equal.
- C. Source Limitations: Obtain weather barrier assembly components from single manufacturer or from manufacturer approved by weather barrier manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Installed weather barrier and accessories shall withstand specified wind pressures, liquid water penetration, and water vapor pressures, without failure due to defective manufacture of products.

2.03 WEATHER BARRIER

- A. Basis of Design Product: Tyvek CommercialWrap and CommercialWrap D or Architect approved equal.
- B. System Description for use with wall panels and siding: Single-Layer Drainable Weather Barrier including flashing and sealing of penetrations and seams.
- C. System Description for use with plaster (stucco) assemblies and stone masonry wall finishes: Double-layer Drainable Weather Barrier including flashing and sealing of penetrations and seams, arranged as follows:
 - a. Primary Layer: Weather barrier with integral drainage installed closest to building interior.
 - b. Secondary Layer: 60 minute Grade D Building paper.
- D. Weather Barrier Characteristics
 - 1. Drainability: 98 percent or greater when tested in accordance with ASTM E 2273.
 - 2. Air Permeance, Product: Not more than 0.001 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.005 L/s x sq. m at 75 Pa) when tested in accordance with ASTM E 2178.
 - 3. Air Permeance, Assembly: Not more than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.2 L/s x sq. m at 75 PA) when tested in accordance with ASTM E 2357 and evaluated by ABAA.
 - 4. Water Penetration Resistance, Product: Hydrostatic head resistance greater than 7.7 feet (2.35 m) in accordance with AATTC 127.
 - Water Penetration Resistance, Assembly: Assembly wall specimen described in ASTM E 2357 to water resistance in accordance with ASTM E 331 to 2.86 lbf/sq. ft. (137 Pa)
 - 6. Water-Vapor Permeance: Not less than 23 perms (1300 ng/Pa x s x sq. m) per ASTM E 96/E 96M, Desiccant Method (Procedure A) or not less than 28 perms (1600 ng/Pa x s x sq. m) per ASTM E 96/E 96M, Water Method (Procedure B).
 - 7. Allowable UV Exposure Time: Not less than nine months when tested in accordance

with ASTM G 155 (Accelerated Weathering).

- 8. Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E 84.
- 9. Weather barrier system to have a VOC content of 30 g/L or less.

2.04 WEATHER BARRIER FLASHING

- A. Conformable Weather Barrier Flashing: Composite flashing material composed of micro- creped, polyethylene laminate with a 100 percent butyl-based adhesive layer able to create a seamless sill pan extending up the jambs without cuts, patches or fasteners; AAMA 711 Class A (no primer), Level 3 thermal exposure, 176 deg. F (80 deg. C) for 7 days.
 - 1. Basis of Design Product: FlexWrap NF or Architect approved equal.
 - 2. Use 6" wide FlexWrap NF with 2 by 4 framing
 - 3. Use 9" wide FlexWrap NF with 2 by 6 framing
- B. Strip Flashing: Composite flashing material composed of spun-bonded polyethylene laminate with 100 percent butyl-based, dual-sided, adhesive layer; AAMA 711, Class A (no primer), Level 3 thermal exposure, 176 deg. F (80 deg. C) for 7 days.
 - 1. Basis of Design Product: StraightFlash and StraightFlash VF or Architect approved equal.
- C. Flashing Characteristics:
 - 1. Water Penetration: No leakage at 15 psf (720 Pa) per ASTM E 331.
 - 2. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm) at 25 deg. F (minus 4 deg. C) as Class A without primer use.
 - 3. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm), after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3, Test B.

2.05 WEATHER BARRIER ACCESSORIES

- A. Seam Tape: Three inch pressure-sensitive plastic tape recommended by weather barrier manufacturer for sealing joints and penetrations in weather barrier.
 - 1. Basis-of-Design Product: DuPont Tyvek Tape or Architect approved equal.
- B. Sealant: Provide sealants that comply with ASTM C920, elastomeric polymer sealant to maintain watertight conditions.
 - 1. OSI QuadMax
 - 2. Dow Corning 732, or 799
 - 3. Or Architect approved equal.
- C. Fasteners:
 - 1. Wood Frame Construction: Tyvek Wrap Caps as manufactured by DuPont; #4 nails with large 1-inch plastic cap fasteners or 1-inch plastic cap staples with leg length sufficient to achieve a minimum penetration of 5/8-inch into the wood stud.
- D. Primer for Flashings: Synthetic rubber-based product; spray applied. Strengthen adhesive bond at low temperature applications between weather products such as self-adhered flashing products, weather barriers, and common building sheathing materials.
 - 1. Basis-of-Design Product: DuPont Adhesive Primer or Architect approved equal.
 - 2. Peel Adhesion Test: Passes in accordance with ASTM D 3330, Test Method F, for the following.

- a. Peel Angles: 0, 25, 72, and 180 degrees.
- b. Substrates: Concrete masonry units (CMU), exterior gypsum sheathing, oriented strand board (OSB), aluminum, and vinyl.
- 3. Chemical Compatibility: Pass; AAMA 713.
- 4. Flame Spread Index: 5; ASTM E 84.
- 5. Smoke Development Index: 0; ASTM E 84.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements.
- B. Verify that substrate and surface conditions are in accordance with commercial weather barrier manufacturer recommendations prior to installation.
 - 1. Verify that rough sill framing for doors and windows is sloped downwards towards the exterior and is level across width of the opening.
- C. Verify that surfaces to receive weather barrier flashing are clean, dry, and free of frost.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Direct water onto an acceptable weather barrier drainage plane with an unobstructed path to exterior of wall.
 - 1. Provide a drainage path for water intrusion through window and door attachment system that collects at window and door sills and directs water to the exterior or weather barrier

3.03 WEATHER BARRIER INSTALLATION

- A. General: Comply with weather barrier manufacturer's written instructions and warranty requirements.
- B. Cover exposed exterior surface of sheathing with weather barrier securely fastened to framing immediately after sheathing is installed.
 - 1. Maintain continuity of air and water barrier assemblies.
 - 2. Start weather barrier installation at a building corner, leaving 12 inches (300 mm) of weather barrier extended beyond corner to overlap.
 - 3. Install weather barrier horizontally starting at lower portion of wall surface.
 - 4. Provide minimum 6 inches (150 mm) overlap at horizontal- and vertical-wrap seams in a shingle manner to maintain continuous downward drainage plane and air and water barrier.
- C. Seams: Seal seams with weather barrier tape per manufacturer's recommended installation instructions.
 - 1. Shiplap horizontal seams in weather barrier to facilitate proper drainage.
- D. Fasteners: Use weather barrier manufacturer's recommended fasteners to secure weather barrier and install fasteners according weather barrier manufacturer's installation guidelines.
 - 1. Do not use temporary fasteners to permanently attach weather barrier.

- 2. Do not place fasteners with gasketing washers where weather barrier flashing will be installed.
- 3. Install fasteners with gasketing washers through flashing where recommended by manufacturer.
- E. Openings: Completely cover openings with weather barrier, then cut weather barrier membrane to openings according to weather barrier manufacturer's installation guidelines.
 - 1. Provide head and jamb flaps and seam overlaps to maintain continuous drainage.
 - 2. Repair damage to weather barrier using method recommended by weather barrier manufacturer.
 - 3. Install flashing according to weather barrier manufacturer's installation guidelines.

3.04 WEATHER BARRIER FLASHING INSTALLATION

- A. Installation: Remove wrinkles and bubbles, reposition weather barrier as necessary to produce a uniform, smooth surface.
 - 1. Ensure that ambient and substrate surface temperatures are acceptable in accordance with manufacturer instructions and recommendations.
 - 2. Wipe surfaces to remove moisture, dirt, grease and other debris that could interfere with adhesion.
 - 3. Apply weather barrier manufacturer's recommended primer over concrete, masonry, and glass-mat gypsum wall sheathing substrates to receive weather barrier flashing.
 - 4. Lap weather barrier flashing a minimum of 2 inches (50 mm) onto weather barrier.
 - 5. Apply pressure over entire surface using roller or firm hand pressure
- B. Rough Openings: Shiplap flashing with weather barrier in a shingle manner to maintain a continuous downward drainage plane and air and water barrier in accordance with manufacturer's written instructions.
 - 1. Apply conformable weather barrier flashing at door and window sills. Provide six inch wide flashing at 2 by 4 framing and nine inch wide flashing at 2 by 6 framing.
 - 2. Ensure that sill flashing does not slope to the interior.
 - 3. Install backer rod in joint between frame of opening product and flashed rough opening on the interior.
 - 4. Apply sealant or closed-cell polyurethane foam insulation around entire opening/fenestration product to create air seal around interior perimeter of window openings in accordance with weather barrier manufacturer's instructions.
 - 5. Around door and window openings, apply butyl-based flashing to flaps of weather barrier.
 - 6. Use strip flashing with wrap cap screws to secure head flap of the windows.
- C. Penetrations: Apply weather barrier manufacturer's recommended weather barrier flashing patches behind fastening plates, such as brick-tie base plates, metal-flashing clips, and metal channels.
 - 1. Seal weather barrier around each penetration with weather barrier manufacturer's recommended self-adhered flashing product or sealant. Integrate products with flanges into the weather barrier.
- D. Terminations: Provide minimum 2 inches (50 mm) overlap using strip flashing on adjoining roof and base of wall systems to maintain continuous downward drainage plane.
 - 1. Secure weather barrier with fasteners and weather-barrier flashing.

3.05 DRAINAGE MATERIAL INSTALLATION

Install drainage material with grooves or channels running vertically in compliance with manufacturer's written instructions.

3.06 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to train installers and observe subject test-wall areas and installations.
- B. Prepare and submit all final observation reports as part of the close-out documents.

3.07 <u>CLEANING</u>

Immediately remove release paper and scrap from work area and dispose of material in accordance with requirements of Section 01 74 00.

3.08 PROTECTION

A. Protect installed weather barrier from the following:

- 1. Damage from cladding, structure, or a component of the structure (e.g., window, door, or wall system).
- 2. Contamination from building site chemicals, premature deterioration of building materials, or nonstandard use or application of products.
- 3. Foreign objects or agents, including the use of materials incompatible with weather barrier products.
- 4. UV exposure in excess of products' stated limits.

END OF SECTION

SECTION 07 26 16

BELOW-GRADE VAPOR BARRIER

PART 1 – GENERAL

1.01 GENERAL REQUIRMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all below-grade vapor barriers, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete and proper installation.
- B. Section includes, but is not limited to:
 - 1. Section 02 06 14 and/or Soils Report for subgrade preparation.
 - 2. Section 03 30 00 Cast-in-Place Concrete.

1.03 STANDARDS AND REFERENCES

- A. ASTM D1709 09 Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- B. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.
- C. ASTM E154 Standard Test Methods for Water Vapor Barriers Used in Contact with Earth Under Concrete Slabs.
- D. ASTM E1643 Standard Practice for Installation of Water Vapor Barriers Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- E. ASTM E1745 Standard Specification for Plastic Water Vapor Barriers Used in Contact with Soil or Granular Fill Under Concrete Slabs.
- F. ASTM F1249-01 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.04 QUALITY ASSURANCE

- A. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapor barrier.
- B. Obtain vapor barrier materials from a single manufacturer regularly engaged in manufacturing the product.
- C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).
- D. Pre-Construction Meeting: Convene one week prior to installation of under slab vapor barrier. Attendees to be as follows: - Architect, Engineer, General Contractor, Vapor Barrier Installer, and Vapor Barrier Manufacturer to discuss the application in detail.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Product Data: Include independent laboratory test results showing compliance with ASTM and ACI Standards. Include manufacturer's installation instructions for placement, seaming, and pipe boot installation.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- D. Store materials in a clean, dry area in accordance with manufacturer's instructions.
- E. Protect materials during handling and application to prevent damage or contamination
- F. Ensure membrane is stamped with manufacturer's name, product name, and membrane thickness at intervals of no more than 85" (220 cm).

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Perminator 15 Mil by W.R. Meadows

- B. Stego Wrap 15 Mil Vapor Barrier by Stego Industries
- C. Vapor-Block 15 Mil by Raven Industries
- D. Or Architect approved equal

2.02 MATERIALS

- A. Vapor Barrier must have the following qualities:
 - 1. 15 mil thickness minimum.
 - 2. Permeance of 0.01 UP perms as tested by ASTM E154.
 - 3. Puncture resistance of 2,200 grams per ASTM D1709, Method B.
 - 4. Tensile Strength of 45lbf/inch as per ASTM E1745-17
 - 5. ASTM E 1745 Class A (Plastics) after conditioning testing.
- B. Vapor Barrier Tape:
 - 1. As recommended by Vapor Barrier Manufacturer.
 - 2. Manufactured from High Density Polyethylene.
 - 3. Pressure Sensitive Adhesive.
- C. Pipe Boots: Construct from vapor barrier sheeting material and pressure sensitive tape in accordance with manufacturer's instructions.
- D. Sand: Clean yard sand, free from excessive dirt, debris, organic matter, and fines smaller than No. 200 sieve size.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Below grade and grading work and items penetrating moisture barrier shall be completed prior to start of installation.
- B. Examine the areas and conditions under which work of this Section will be performed.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION REQUIREMENTS

- A. Vapor Barrier Sheeting:
 - 1. Install in accordance with manufacturer's instructions and ASTM E1643.
 - 2. Unroll with the longest dimension parallel with the direction of the pour.
 - 3. Lap vapor barrier over footings and seal to foundation walls.
 - 4. Overlap joints 6-inches and seal with manufacturer's pressure sensitive tape.
 - 5. Seal penetrations, including pipes, with pipe boot.
 - 6. Penetrations through vapor barrier sheeting except for reinforcing steel and permanent utilities are not permitted.
 - 7. Repair damaged areas by cutting patches of vapor barrier sheeting, overlapping damaged area 6-inches and taping all four sides with pressure sensitive tape.

- B. Sand Cushion:
 - 1. Provide 2-inch layer over moisture barrier, unless otherwise indicated.
 - 2. Spread over surfaces required and work to fill voids; leave in stable condition with finished surfaces reasonably uniform at established grade.

END OF SECTION

SECTION 07 54 00

THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

A. Scope

To install an adhered Single Ply Thermoplastic (PVC) Roofing Membrane with flashings and other system components to comprise a roofing system for the Niland Public Safety Facility, Niland, CA. Install new ¼" Dens Deck Prime separation board by mechanically attachment over the sloped plywood decking. Adhere single ply roof membrane; tapered insulation to provide for crickets. Provide details as shown on the roof plan and detail sheet.

- B. Related Work: The work includes but is not necessarily limited to the installation of:
 - 1. Substrate Preparation
 - 2. Wood Blocking
 - 3. Separation Board
 - 4. Rigid Insulation, Crickets
 - 5. Roof Membrane
 - 6. Fasteners
 - 7. Adhesive for Flashings
 - 8. Roof Membrane Flashings
 - 9. Walkways
 - 10. Metal Flashings
 - 11. Sealants
 - 12. Clad Edge Metal
- C. Upon successful completion of work the following warranties may be obtained:
 - 1. Manufacturer Warranty
 - 2. Roofing Contractor Warranty

1.03 STANDARDS AND REFERENCES

The applicator shall submit evidence that the proposed roof system meets the requirements of the local building code and has been tested and approved or listed by the following test organizations. These requirements are minimum standards and no roofing work shall commence without written documentation of the system's compliance, as required in the "Submittals" section of this specification.

- A. Factory Mutual Research Corporation (FM) Norwood, MA
 - 1. Class 1-90 (Attachment Criteria)

- B. Underwriters Laboratories, Inc. Northbrook, IL
 - 1. Class A assembly

1.04 QUALITY ASSURANCE

- A. Membrane Manufacturer must certify that the proposed equal has a membrane thickness equal to the membrane thickness specified 60 mils thick, without ASTM (+/-) mil tolerance, as such tolerance is not acceptable. The felt backing shall not be included when measuring membrane thickness.
- B. Membrane must have at least twenty-seven (27) mils of waterproofing polymers above the reinforcement as documented in the Typical Physical Properties section of the Manufacturer's published Product Data Sheet for 60 mil membranes.
- C. Roofing Membrane Manufacturer must have a demonstrated performance history of producing thermoplastic membranes no less, in duration of years, than the warranty duration specified.
- D. Membrane Manufacturer must provide a list of at least 10 (ten) projects in which the submitted roofing material has been performing for the specified warranty duration. Membranes with modified formulation changes and undocumented proven performance will not be accepted.
- E. Membrane Manufacturer must not require the use of membrane cut edge sealant at any location. This is a maintenance item that the Owner does not accept.
- F. Manufacturer's warranty must have "No Dollar Limit" for the replacement of defective materials and labor with no exclusions for ponding water.
- G. Membrane Manufacturer to confirm in writing that they directly manufacture the roofing membrane; private labeled membranes are not acceptable.
- H. Membrane Manufacturer must have an established program for recycling membrane at the end of its useful life. Must provide 3 (three) instances in which they have done so.
- I. Membrane Manufacturer must have recycled content certification from UL (Underwriters Laboratories) Environment.
- J. Membrane Manufacturer must have ISO 14001 Certification and a Responsible Care program in place.
- K. Upon completion of the installation and the delivery to the Manufacturer, by the Applicator of certification, that all work has been done in strict accordance with the contract specifications and Membrane Manufacturer's requirements, a Technical Service Representative will review the installed roof system.
- L. There is no deviation made from the project specification or the approved shop drawings without prior written approval by the Architect, the Owner's Representative and Roofing Manufacturer.
- M. The installer must have a minimum of 5 years' experience in installing roofing system of this type and nature. Contractor must be certified and approved by the roofing materials Manufacturer.
- N. All work pertaining to the installation of PVC membrane and flashings must only be completed by Applicator personnel trained and authorized by roofing Manufacturer in those procedures.
- O. Membrane to have no formulation changes in the last fifteen (15) years as certified by the manufacturer.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. All submittals which do not conform to the following requirements will be rejected. Submit proposed equals to be considered for use on this project no less than ten (10) days prior to bid date. Proposed roof systems which have been reviewed and accepted will be listed in an addendum prior to bid date; only then will roof systems be accepted at bidding. Submittals shall include the following:
 - 1. Copies of Specification including physical properties.
 - 2. Samples of each primary component to be used in the roof system and the manufacturer's current literature for each component.
 - 3. Written approval by the insulation manufacturer (as applicable) for use and performance of the product in the proposed system.
 - 4. Sample copy of Manufacturer's warranty including no exclusion for ponding water and no time limit shall be assigned to any such ponding water.
 - 5. Sample copy of Applicator's warranty.
 - 6. Dimensioned shop drawings which shall include:
 - a. Outline of roof with roof size and elevations shown.
 - b. Profile details of flashing methods for penetrations.
 - c. Technical acceptance from Manufacturer.
 - 7. Certifications by manufacturers of roofing and insulating materials that all materials supplied comply with all requirements of the identified ASTM and industry standards or practices and requirements of this specification as stated in Section 2.01, C & D and all requirements listed in Quality Assurance.
 - 8. Certification from the Applicator that the system specified meets all identified code and insurance requirements as required by the Specification.
 - 9. Letter from the proposed manufacturer confirming the number of years it has DIRECTLY manufactured the proposed roof system under the trade names and/or trademarks as proposed.
 - 10. Material Safety Data Sheets (MSDS)

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. All products delivered to the job site shall be in the original unopened containers or wrappings bearing all seals and approvals.
- D. Handle all materials to prevent damage. Place all materials on pallets and fully protect from moisture.

- E. Membrane rolls shall be stored lying down on pallets and fully protected from the weather with clean canvas tarpaulins. Unvented polyethylene tarpaulins are not accepted due to the accumulation of moisture beneath the tarpaulin in certain weather conditions that may affect the ease of membrane weldability.
- F. All adhesives shall be stored at temperatures between 40° F (5° C) and 80° F (27° C).
- G. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on containers or supplied by material manufacturer/supplier.
- H. All materials which are determined to be damaged by the Owner's Representative or the manufacturer are to be removed from the job site and replaced at no cost to the Owner.

1.08 JOB CONDITIONS

- A. Membrane materials may be installed under certain adverse weather conditions but only after consultation with the Manufacturer, as installation time and system integrity may be affected.
- B. Only as much of the new roofing as can be made weathertight each day, including all flashing and detail work, shall be installed. All seams shall be cleaned and heat welded before leaving the job site that day.
- C. All work shall be scheduled and executed without exposing the interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.
- D. All surfaces to receive new insulation, membrane or flashings shall be dry. Should surface moisture occur, the Applicator shall provide the necessary equipment to dry the surface prior to the application.
- E. All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.
- F. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.
- G. The Applicator is cautioned that certain membranes are incompatible with asphalt, coal tar, heavy oils, roofing cements, creosote and some preservative materials. Such materials shall not remain in contact with the membranes. The Applicator shall consult the manufacturer regarding compatibility, precautions and recommendations.
- H. Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the general contractor or construction manager shall provide for all necessary protection and barriers as required to segregate the work area and to prevent damage to adjacent areas. A substantial protection layer consisting of plywood over Felt or plywood over insulation board shall be provided for all new and existing roof areas that receive rooftop traffic during construction.
- I. Prior to and during application, all dirt, debris and dust shall be removed from surfaces by vacuuming, sweeping, blowing with compressed air and/or similar methods.
- J. The Applicator shall follow all safety regulations as required by OSHA and any other applicable authority having jurisdiction.
- K. All roofing, insulation, flashings and metal work removed during construction shall be immediately taken off site to a legal dumping area authorized to receive such materials. Hazardous materials, such as materials containing asbestos, are to be removed and disposed of in strict accordance with applicable City, State and Federal requirements.

- L. All new roofing waste material (i.e., scrap roof membrane, empty cans of adhesive) shall be immediately removed from the site by the Applicator and properly transported to a legal dumping area authorized to receive such material.
- M. The Applicator shall take precautions that storage and/or application of materials and/or equipment does not overload the roof deck or building structure.
- N. Flammable adhesives and deck primers shall not be stored and not be used in the vicinity of open flames, sparks and excessive heat.
- O. All rooftop contamination that is anticipated or that is occurring shall be reported to the manufacturer to determine the corrective steps to be taken.
- P. The Applicator shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Applicator shall report any such blockages in writing (letter copy to the manufacturer) to the Owner's Representative for corrective action prior to installation of the roof system.
- Q. Applicator shall immediately stop work if any unusual or concealed condition is discovered and shall immediately notify Owner of such condition in writing for correction at the Owner's expense (letter copy to the manufacturer).
- R. Site cleanup, including both interior and exterior building areas that have been affected by construction, shall be completed to the Owner's satisfaction.
- S. All landscaped areas damaged by construction activities shall be repaired at no cost to the Owner.
- T. The Applicator shall conduct fastener pullout tests in accordance with the latest revision of the SPRI/ANSI Fastener Pullout Standard to help verify condition of deck/substrate and to confirm expected pullout values.
- U. The adhered membrane shall not be installed under the following conditions without consulting the manufacturer's technical department for precautionary steps:
 - 1. The roof assembly permits interior air to pressurize the membrane underside.
 - 2. Any exterior wall has 10% or more of the surface area comprised of opening doors or windows.
 - 3. The wall/deck intersection permits air entry into the wall flashing area.
- V. Precautions shall be taken when using adhesives at or near rooftop vents or air intakes. Adhesive odors could enter the building. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odor while ventilating the building. Keep lids on unused cans at all times.
- W. Protective wear shall be worn when using solvents or adhesives or as required by job conditions.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

Not required.

1.11 RECORD DRAWINGS

Not required.

1.12 BIDDING REQUIREMENTS

- A. Pre-Bid Meeting: A pre-bid meeting shall be held with the Owner's Representative and involved trades to discuss all aspects of the project. The Applicator's field representative or roofing foreman for the work shall be in attendance. Procedures to avoid rooftop damage by other trades shall be determined.
- B. Site Visit: Bidders shall visit the site and carefully examine the areas in question as to conditions that may affect proper execution of the work. All dimensions and quantities shall be determined or verified by the contractor. No claims for extra costs will be allowed because of lack of full knowledge of the existing conditions unless agreed to in advance with the Owner or Owner's Representative.

1.13 WARRANTIES

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide in accordance with Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Manufacturer's System Warranty (only products purchased from the membrane manufacturer are covered under System Warranty): Upon successful completion of the work to the Roofing Manufacturer's and Owner's satisfaction, and receipt of final payment, the twenty (20) Year System Warranty shall be issued. The System Warranty shall provide for the roof membrane, all accessories that comprise a roof system, and contractor labor. The Warranty shall be Non-Prorated provide for No Dollar Limit (NDL), and shall not exclude ponding water and no time limited shall be assigned for any such ponding water during the warranty period. Warranty shall not exclude regular foot traffic or storage on the roof surface, and it shall not obligate the owner to a maintenance schedule of any type as a condition of the warranty.
- E. Applicator/Roofing Contractor Warranty: The Applicator shall supply the Owner with a separate five-year workmanship warranty. In the event any work related to roofing, flashing, or metal is found to be within the Applicator warranty term, defective or otherwise not in accordance with the Contract Documents, the Applicator shall repair that defect at no cost to the Owner. The Applicator's warranty obligation shall run directly to the Owner, and a copy shall be sent to the manufacturer.
- F. Owner Responsibility: Owner shall notify both the manufacturer and the Applicator of any leaks as they occur during the time period when both warranties are in effect.

PART 2 – PRODUCTS

2.01 <u>GENERAL</u>

- A. The components of the Adhered roof system are to be products of the membrane manufacturer as indicated on the Detail Drawings and specified in the Contract Documents.
- B. Components to be used that are other than those supplied or manufactured by the membrane manufacturer may be submitted for review and acceptance by the manufacturer. The manufacturer's acceptance of any other product is only for a determination of compatibility with membrane products and not for inclusion in the manufacturer's warranty. The specifications, installation instructions, limitations, and/or restrictions of the respective manufacturers must be reviewed by the Owner's Representative for acceptability for the intended use with the manufacturer's products.

- C. Membrane shall be certified by the manufacturer to be the exact thickness as specified, ASTM tolerance does not apply.
- D. Membrane shall have a minimum of twenty-seven (27) mils of waterproofing polymers above the reinforcements as documented by a third party source.

2.02 MEMBRANE

- A. Sarnafil[®] G410 Feltback fiberglass reinforced membrane with a factory-applied integral lacquer coating to repel dirt and sustain reflectivity.
- B. Membrane shall conform to ASTM D4434-15 (or latest revision), "Standard for Polyvinyl Chloride Sheet Roofing". Classification: Type II, Grade I.
 - 1. Sarnafil G410-15 feltback, 60 mil (1.50 mm), thermoplastic membrane with fiberglass reinforcement and a factory applied 9 oz. geotextile felt backing.
 - 2. Or Pre-Approved Equal, subject to compliance with all specification requirements herein so stated. KEE and other like-type, non-conforming membrane products will not be approved as equal.
- C. Color of Membrane
 - 1. EnergySmart feltback (White), initial reflectivity of 0.83, initial emissivity 0.92, solar reflective index (SRI) of >104.
- D. Typical Physical Properties

	ASTM	Minimum ASTM
Parameters	Test Method	<u>Requirement</u>
Reinforcing Material	-	Fiberglass
Overall Thickness, min., inches (mm)	D638	[0.060inches)]
Tensile Strength, min., psi (MPa)	D638	1600 (11.1)
Elongation at Break, min. (machine x tranverse)	D638	270% / 250%
Seam strength*, min. (% of tensile strength)	D638	80
Retention of Properties After Heat Aging	D3045	-
Tensile Strength, min., (% of original)	D638	95
Elongation, min., (% of original)	D638	90
Tearing Resistance, min., lbf (N)	D1004	14 (63.0)
Low Temperature Bend, -40° F (-40° C)	D2136	Pass
Accelerated Weathering Test (Xenon Arc)	D2565	10,000 Hours
Cracking (7x magnification)	-	None
Discoloration (by observation)	-	Negligible
Crazing (7 x magnification)	-	None
Linear Dimensional Change	D1204	0.02%
Weight Change After Immersion in Water	D570	2.5%
Static Puncture Resistance, 33 lbf (15 kg)	D5602	Pass
Dynamic Puncture Resistance, 7.3 ft-lbf (10 J)	D5635	Pass

*Failure occurs through membrane rupture not seam failure.

2.03 FLASHING MATERIALS

- A. Wall/Curb/Perimeter Flashing
 - 1. Flashing Membrane: A fiberglass reinforced membrane adhered to approved substrate using adhesive.
 - 2. Clad: A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Clad is a 25 gauge, G90 galvanized metal sheet with a 20 mil (1 mm) unsupported membrane laminated on one side.
- B. Miscellaneous Flashing
 - 1. Flash: A prefabricated expansion joint cover made from membrane. Flash is designed for securement to wall or horizontal surfaces to span and accommodate the movement of new and existing expansion gaps from 1 inch to 4½ inches (25 mm to 114 mm) across.
 - Reglet: A heavy-duty, extruded aluminum flashing termination reglet used at walls and large curbs. Reglet is produced from 6063-T5, 0.10 inch - 0.12 inch (2.5 mm -3.0 mm) thick extruded aluminum. Reglet has a 2¼ inch (57 mm) deep profile, and is provided in 10 foot (3 m) lengths. Use prefabricated Reglet mitered inside and outside corners where walls intersect.
 - 3. Stack: A prefabricated vent pipe flashing made from 0.048 inch (48 mil/1.2 mm) thick G410 membrane.
 - 4. Circle-"G": Circular 0.048 inch (48 mil/1.2 mm) thick G410 membrane patch welded over T-joints formed by overlapping thick membranes.
 - 5. Corner: Prefabricated outside and inside flashing corners made of 0.060 inch (60 mil/1.5 mm) thick membrane that are heat-welded to membrane or Clad base flashings. Corner is available in 2 outside sizes (5 inch and 8½ inch diameter/127 mm and 215 mm) and 1 inside size.
 - 6. Multi-Purpose Sealant: A sealant used at flashing terminations.
 - 7. StaBond Adhesive: A solvent-based reactivating-type adhesive used to attach membrane to flashing substrate.
 - 8. Felt: A non-woven polyester or polypropylene mat cushion layer that is necessary behind G410 or G459 Flashing Membrane when the flashing substrates are rough-surfaced or incompatible with the flashing membrane.
 - 9. Flashing G459 Membrane: An asphalt-resistant, fiberglass reinforced membrane adhered to approved substrate using adhesive.

2.04 SEPARATION BOARD

A. Dens-Deck Prime^{®:} A siliconized gypsum, fire-tested hardboard with glass-mat facers. Dens-Deck Prime is provided in a 4 ft x 8 ft (1.2 m x 2.4 m) board size and in thickness of 1/4" for horizontal application over plywood decking and cricketed insulation. Use ¼" boards for application on the screen wall applied over plywood sheathing. For application direct to parapet wall studs, ½" board is required.

2.05 INSULATION

A. Insulation: A rigid (or tapered) polyisocyanate foam insulation board with black mat facers. Insulation is available in various board size thicknesses. Provide crickets as shown on the roof plan.

2.06 <u>AIR BARRIER</u>

A. A self-adhered 31 Mil vapor barrier that can also serve as a temporary roof protection. The top surface is a high-density polyethylene grid laminated between two layers of polyethylene film. A silicone release plastic film covers the self-adhesive back side

2.07 ATTACHMENT COMPONENTS

A. Membrane adhesive: 2121 Adhesive: A water-based adhesive used to attach the membrane to horizontal or near-horizontal substrates. Application rates are as follows:

APPLICATION RATES FOR FELTBACK MEMBRANE						
	Adhesive Rates -	Approximate				
	Substrate	Membrane	Total	<u>Sq. Ft./Pail</u> (meter ²)		
				(
GP Dens-Deck [®]	1.75 (0.71)	+ 0	= 1.75 (0.71)	285 (26.48)		

Notes:

- a) There is a significant increase in drying time due to an increase in humidity and/or a decrease in temperature. Do not install when outdoor or substrate temperatures during drying period are expected to fall below 40° F (5° C).
- b) Do not allow 2121 adhesive to skin-over or surface-dry prior to installation of membrane.
- c) Use a water-filled, foam-covered lawn roller to consistently and evenly press the membrane into the adhesive layer.
- B. Plate: Used with various Fasteners to attach insulation boards to roof deck. Plate is a 3 inch (75 mm) square or round, 26 gauge stamping of SAE 1010 steel with an AZ 55 Galvalume coating.
- C. Fastener No. 12: Number 12 corrosion-resistant fastener used with Plates to attach insulation boards to steel or wood roof decks. Fastener No. 12 has a modified buttress thread, a shank diameter of approximately 0.168 inch (4 mm) and a thread diameter of approximately 0.214 inch (5 mm). The driving head has a diameter of approximately 0.435 inch (11 mm) with a #3 Phillips recess for positive engagement.
- D. Fastener-XP: A #15, heavy-duty, corrosion-resistant fastener used with Plate to attach insulation or Stop and Bar to attach G410 roof membrane to steel or wood roof decks. Fastener-XP has a shank diameter of approximately 0.21 inch (5.3 mm) and the thread diameter is approximately 0.26 inch (6.6 mm). The driving head has a diameter of approximately 0.435 inch (11 mm) with a #3 Phillips recess for positive engagement.
- E. Fastener-XPS: A specially designed, heavy-duty, corrosion-resistant fastener used with Stop or Bar to attach G410 roof membrane to steel roof decks. Fastener-XPS has a shank diameter of approximately 0.21 inch (5.3mm) and a thread diameter of approximately 0.26

inch (6.6). The driving head has a diameter of approximately 0.435 inch (11 mm) with a #3 Phillips recess for positive engagement and simplicity of application.

- F. Fastener-King Con: A nail-in, corrosion-resistant fastener used with Plate to attach insulation or with Bar to attach membrane to poured structural concrete roof decks.
- G. Stop: An extruded aluminum, low profile bar used with certain Fasteners to attach to the roof deck or to walls/curbs at terminations, penetrations and at incline changes of the substrate. Stop is a 1 inch (25 mm) wide, flat aluminum bar 1/8 inch (3 mm) thick that has predrilled holes every 6 inches (152 mm) on center.
- H. Bar: An FM-approved, heavy-duty, 14 gauge, galvanized or stainless, roll-formed steel bar used to attach membrane to roof decks. The formed steel is pre-punched with holes every 1 inch (25 mm) on center to allow various Fastener spacing options.
- I. Cord: A 5/32 inch (4 mm) diameter, red-colored, flexible thermoplastic extrusion that is welded to the top surface of the membrane and against the side of the Bar, used to hold the membrane in position.

2.08 WALKWAY PROTECTION

A. Tread: A polyester reinforced, 0.096 inch (96 mil/2.4 mm), weldable membrane with surface embossment. Used as a protection layer from rooftop traffic. Tread is supplied in rolls of 39.3 inches (1.0 m) wide and 32.8 feet (10 m) long.

2.09 MISCELLANEOUS ACCESSORIES

- A. Aluminum Tape: a 2-inch (50 mm) wide pressure-sensitive aluminum tape used as a separation layer between small areas of asphalt contamination and the membrane and as a bond-breaker under the coverstrip at Clad joints.
- B. Sealing Tape Strip: Compressible foam with pressure-sensitive adhesive on one side. Used with metal flashings as a preventive measure against air and wind-blown moisture entry.
- C. Multi-Purpose Tape: A high performance sealant tape with used with metal flashings as a preventive measure against air and wind blown moisture entry.
- D. Seam Welder 641mc: 220 volt, self-propelled, hot-air welding machine used to seal long lengths of membrane seams.
- E. Perimat Welder: 120 volt, self-propelled, hot-air welding machine used to seal long-lengths of membrane seams along perimeter details.
- F. Solvent: A high quality solvent cleaner used for the general cleaning of residual asphalt, scuff marks, etc., from the membrane surface. Solvent is also used daily to clean seam areas prior to hot-air welding in tear off or dirty conditions or if the membrane is not welded the same day it is unrolled. Consult Product Data Sheet for additional information.

2.10 MISCELLANEOUS FASTENERS AND ANCHORS

A. All fasteners, anchors, nails, straps, bars, etc. shall be post-galvanized steel, aluminum or stainless steel. Mixing metal types and methods of contact shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. All concrete fasteners and anchors shall have a minimum embedment of 1¼ inch (32 mm) and shall be approved for such use by the fastener manufacturer. All miscellaneous wood fasteners and anchors used for flashings shall have a minimum embedment of 1 inch (25 mm) and shall be approved for such use by the fastener manufacturer.

2.11 RELATED MATERIALS

A. Wood Nailer: Treated wood nailers shall be installed at the perimeter of the entire roof and around such other roof projections and penetrations as specified on Project Drawings. Thickness of nailers must match the insulation thickness to achieve a smooth transition.

Wood nailers shall be treated for fire and rot resistance (wolmanized or osmose treated) and be #2 quality or better lumber. Creosote or asphalt-treated wood is not acceptable. Wood nailers shall conform to Factory Mutual Loss Prevention Data Sheet 1-49. All wood shall have a maximum moisture content of 19% by weight on a dry-weight basis.

B. Plywood: When bonding directly to plywood, a minimum ½ inch (12 mm) CDX (C side out), smooth-surfaced exterior grade plywood with exterior grade glue shall be used. Rough-surfaced plywood or high fastener heads will require the use of Felt behind the flashing membrane. Plywood shall have a maximum moisture content of 19% by weight on a dry weight basis.

PART 3 – EXECUTION

3.01 PRE-CONSTRUCTION CONFERENCE

- A. The Applicator, Owner's Representative/Designer and Manufacturer(s) shall attend a preconstruction conference.
- B. The meeting shall discuss all aspects of the project including but not limited to:
 - 1. Safety
 - 2. Set up
 - 3. Construction schedule
 - 4. Contract conditions
 - 5. Coordination of the work

3.02 SUBSTRATE CONDITION

- A. Applicator shall be responsible for acceptance or provision of proper substrate to receive new roofing materials.
- B. Applicator shall verify that the work done under related sections meets the following conditions:
 - 1. Roof drains and/or scuppers have been reconditioned and/or replaced and installed properly.
 - 2. Roof curbs, nailers, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new roofing materials.
 - 3. All surfaces are smooth and free of dirt, debris and incompatible materials.
 - 4. All roof surfaces shall be free of water, ice and snow.

3.03 SUBSTRATE PREPARATION

The roof deck and existing roof construction must be structurally sound to provide support for the new roof system. The Applicator shall load materials on the rooftop in such a manner to eliminate risk of deck overload due to concentrated weight. The Owner's Representative shall ensure that the roof deck is secured to the structural framing according to local building code and in such a manner as to resist all anticipated wind loads in that location.

A. New Construction

- 1. Wood Deck:
 - a) FM approved wood deck The roof deck shall be minimum 2 inch (50 mm) thick lumber or ³/₄ inch (19 mm) thick treated plywood. The deck shall conform to FM requirements for Class 1 fire-retardant and rot-resistant wood decks. Deck shall be installed according to FM and local code requirements.
 - b) Non-FM approved wood deck The roof deck shall be minimum 1½ inch (25 mm) thick lumber or 15/32 inch (12 mm) thick plywood. Deck shall be installed according to local code requirements. Contact Manufacturer's Technical for fastening patterns and methods.

3.04 SUBSTRATE INSPECTION

- A. A dry, clean and smooth substrate shall be prepared to receive the Adhered roof system.
- B. The Applicator shall inspect the substrate for defects such as excessive surface roughness, contamination, structural inadequacy, or any other condition that will adversely affect the quality of work.
- C. The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.
- D. All roof surfaces shall be free of water, ice and snow.
- E. The membrane shall be applied over compatible and accepted substrates only.

3.05 WOOD NAILER INSTALLATION

- A. Install continuous wood nailers at the perimeter of the entire roof and around roof projections and penetrations as shown on the Detail Drawings.
- B. Nailers shall be anchored to resist a minimum force of 300 pounds per lineal foot (4,500 Newtons/lineal meter) in any direction. Individual nailer lengths shall not be less than 3 feet (0.9 meter) long. Nailer fastener spacing shall be at 12 inches (0.3 m) on center or 16 inches (0.4 m) on center if necessary to match the structural framing. Fasteners shall be staggered 1/3 the nailer width and installed within 6 inches (0.15 m) of each end. Two fasteners shall be installed at ends of nailer lengths. Nailer attachment shall meet this requirement and that of the current Factory Mutual Loss Prevention Data Sheet 1-49.
- C. Thickness shall be as required to match substrate or insulation height to allow a smooth transition.
- D. Any existing nailer woodwork which is to remain shall be firmly anchored in place to resist a minimum force of 300 pounds per lineal foot (4,500 Newtons/lineal meter) in any direction and shall be free of rot, excess moisture or deterioration. Only woodwork shown to be reused in Detail Drawings shall be left in place. All other nailer woodwork shall be removed.

3.06 SEPARATION BOARD AND INSULATION INSTALLATION

- A. Separation board and insulation shall be installed according to insulation manufacturer's instructions.
- B. Separation board and insulation shall be neatly cut to fit around penetrations and projections.
- C. Install tapered insulation in accordance with insulation manufacturer's shop drawings.
- D. Install tapered insulation around drains creating a drain sump.
- E. Do not install more insulation board than can be covered with the membrane by the end of the day or the onset of inclement weather.
- F. Use at least 2 layers of insulation when the total insulation thickness exceeds 2½ inches (64 mm). Stagger joints at least 12 inches (0.3 m) between layers.
- G. Mechanical Attachment

- 1. Separation board and insulation shall be mechanically fastened to the deck with approved fasteners and plates at a rate according to the separation board and insulation manufacturer's, FM's and the manufacturer's recommendations for fastening rates and patterns. The quantity and locations of the fasteners and plates shall also cause the insulation or separation boards to rest evenly on the roof deck/substrate so that there are no significant and avoidable air spaces between the boards and the substrate. Each insulation board shall be installed tightly against the adjacent boards on all sides.
- 2. Fasteners are to be installed consistently in accordance with fastener manufacturer's recommendations. Fasteners are to have minimum penetration into structural deck recommended by the fastener manufacturer and the membrane manufacturer.
- 3. Use fastener tools with a depth locator and torque-limiting attachment as recommended or supplied by fastener manufacturer to ensure proper installation.

3.07 INSTALLATION OF ROOF MEMBRANE

The surface of the insulation or substrate shall be inspected prior to installation of the roof membrane. The substrate shall be clean, dry, free from debris and smooth with no surface roughness or contamination. Broken, delaminated, wet or damaged insulation boards shall be removed and replaced.

A. 2121 Adhesive:

- Over the properly installed and prepared substrate, 2121 adhesive shall be poured out of the pail and spread using notched ¼ inch x ¼ inch x ¼ inch (6 mm x 6 mm x 6 mm) rubber squeegees. The 2121 adhesive shall be applied at a rate according to the manufacturer's requirements. No adhesive is applied to the back of the G410 feltback membrane. Do not allow adhesive to skin-over or surface-dry prior to installation of G410 feltback membrane.
- 2. The G410 feltback roof membrane is unrolled immediately into the wet 2121 adhesive. Adjacent rolls overlap previous rolls by 3 inches (75 mm). This process is repeated throughout the roof area. Immediately after application into adhesive, each roll shall be pressed firmly into place with a water-filled, foam-covered lawn roller by frequent rolling in two directions. **Do not allow adhesive to skin-over or surface-dry prior to installation of G410 feltback membrane.**
- 3. Weld G410 coverstrips at all G410 feltback seams that do not have a factory selvage edge. Notes:
 - a. 2121 adhesive shall not be used if temperatures below 40° F (5° C) are expected during application or subsequent drying time.
 - b. No adhesive shall be applied in seam areas. All membrane shall be applied in the same manner.

3.08 HOT-AIR WELDING OF SEAM OVERLAPS

- A. General
 - 1. All seams shall be hot-air welded. Seam overlaps should be 3 inches (75 mm) wide when automatic machine-welding and 4 inches (100 mm) wide when hand-welding, except for certain details.
 - 2. Welding equipment shall be provided by or approved by the manufacturer. All mechanics intending to use the equipment shall have successfully completed a training course provided by a Technical Representative prior to welding.
 - 3. All membrane to be welded shall be clean and dry.
- B. Hand-Welding

- 1. Hand-welded seams shall be completed in two stages. Hot-air welding equipment shall be allowed to warm up for at least one minute prior to welding.
- 2. The back edge of the seam shall be welded with a narrow but continuous weld to prevent loss of hot air during the final welding.
- 3. The nozzle shall be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to "flow," the hand roller is positioned perpendicular to the nozzle and pressed lightly. For straight seams, the 1½ inch (40 mm) wide nozzle is recommended for use. For corners and compound connections, the ¾ inch (20 mm) wide nozzle shall be used.
- C. Machine Welding
 - 1. Machine welded seams are achieved by the use of automatic welding equipment. When using this equipment, the manufacturer's instructions shall be followed and local codes for electric supply, grounding and over current protection observed. Dedicated circuit house power or a dedicated portable generator is recommended. No other equipment shall be operated off the generator.
 - 2. Metal tracks may be used over the deck membrane and under the machine welder to minimize or eliminate wrinkles.
- D. Quality Control of Welded Seams
 - 1. The Applicator shall check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark grey material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the Applicator to locations as directed by the Owner's Representative or a manufacturer's representative. One inch (25 mm) wide cross-section samples of welded seams shall be taken at least three times a day. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Applicator at no extra cost to the Owner.

3.09 MEMBRANE FLASHINGS

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and the manufacturer. Approval shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Applicator's expense. Flashing shall be adhered to compatible, dry, smooth, and solvent-resistant surfaces. Use caution to ensure adhesive fumes are not drawn into the building.

- A. Adhesive for Membrane Flashings
 - 1. Over the properly installed and prepared flashing substrate, adhesive shall be applied according to instructions found on the Product Data Sheet. The adhesive shall be applied in smooth, even coats with no gaps, globs or similar inconsistencies. Only an area which can be completely covered in the same day's operations shall be flashed. The bonded sheet shall be pressed firmly in place with a hand roller.
 - 2. No adhesive shall be applied in seam areas that are to be welded. All panels of membrane shall be applied in the same manner, overlapping the edges of the panels as required by welding techniques.
- B. Install Stop/Bar/Cord according to the Detail Drawings with approved fasteners into the structural deck at the base of parapets, walls and curbs. Stop is required by the manufacturer at the base of all tapered edge strips and at transitions, peaks, and valleys according to the manufacturer's details.

- C. The manufacturer's requirements and recommendations and the specifications shall be followed. All material submittals shall have been accepted by the manufacturer prior to installation.
- D. All flashings shall extend a minimum of 8 inches (0.2 m) above roofing level unless otherwise accepted in writing by the Owner's Representative and the Technical Department.
- E. All flashing membranes shall be consistently adhered to substrates. All interior and exterior corners and miters shall be cut and hot-air welded into place. No bitumen shall be in contact with the membrane.
- F. All flashing membranes shall be mechanically fastened along the counter-flashed top edge with Stop at 6-8 inches (0.15-0.20 m) on center.
- G. Flashings shall be terminated according to the manufacturer's recommended details.
- H. All flashings that exceed 30 inches (0.75 m) in height shall receive additional securement. Consult Technical Department for securement methods.

3.10 METAL FLASHINGS

- A. Metal details, fabrication practices and installation methods shall conform to the applicable requirements of the following:
 - 1. Factory Mutual Loss Prevention Data Sheet 1-49 (latest issue).
 - 2. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) latest issue.
- B. Metal, other than that provided by the manufacturer, is not covered under the warranty.
- C. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily.
- D. Metal shall be installed to provide adequate resistance to bending to allow for normal thermal expansion and contraction.
- E. Metal joints shall be watertight.
- F. Metal flashings shall be securely fastened into solid wood blocking. Fasteners shall penetrate the wood nailer a minimum of 1 inch (25 mm).
- G. Airtight and continuous metal hook strips are required behind metal fascias. Hook strips are to be fastened 12 inches (0.3 m) on center into the wood nailer or masonry wall.
- H. Counter flashings shall overlap base flashings at least 4 inches (100 mm).
- I. Hook strips shall extend past wood nailers over wall surfaces by 1½ inch (38 mm) minimum and shall be securely sealed from air entry.

3.11 AIR BARRIER INSTALLATION

- A. Install Self-Adhered (SA 31) vapor retarder over a clean and dry substrate. In concrete applications, allow concrete to cure for a least 7 days. Do not install when it is raining, snowing, or on wet / humid surfaces. Install in temperatures 32 degrees F (0 degrees C) and above. The use of a primer is required on the following substrates: wood, concrete, lightweight concrete, gypsum boards and decks, and Dens Deck boards.
 - Begin application at the bottom of the slope. Unroll Sarnavap Self-Adhered onto the substrate without adhering for alignment. Overlap each preceding sheet by 3 in. (75 mm) lengthwise following the reference line and by 6 in. (150 mm) at each end. Stagger end laps by at least 12 in. (300 mm). Do not immediately remove the silicone release sheet.

- 2. Once aligned, peel back a portion of the silicone release sheet and press the membrane onto the substrate for initial adherence. Hold Sarnavap Self-Adhered tight and peel back the release sheet by pulling diagonally.
- 3. Use a 75 lbs. (34 kg) roller to press Sarnavap Self-Adhered down into the substrate including the laps. Finish by aligning the edge of the roller with the lower end of the side laps and rolling up the membrane. Do not cut the membrane to remove air bubbles trapped under the laps. Squeeze out air bubbles by pushing the roller to the edge of the laps.

3.12 CLAD METAL BASE FLASHINGS / EDGE METAL

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and the manufacturer. Acceptance shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, the affected area shall be removed and replaced at the Applicator's expense.

- A. Clad metal flashings shall be formed and installed per the Detail Drawings.
 - 1. All metal flashings shall be fastened into solid wood nailers with two rows of post galvanized flat head annular ring nails, 4 inches (100 mm) on center staggered. Fasteners shall penetrate the nailer a minimum of 1 inch (25 mm).
 - 2. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.
- B. Adjacent sheets of Clad shall be spaced ¼ inch (6 mm) apart. The joint shall be covered with 2 inch (50 mm) wide aluminum tape. A 4 inch minimum (100 mm) wide strip of flashing membrane shall be hot-air welded over the joint. Each flashed joint shall be covered by a clad metal facia plate to match the color of the clad edge metal. Install the clad fascia plate per Sarnafil standards.

3.13 WALKWAY INSTALLATION

A. Tread Walkway

 Roofing membrane to receive the Tread Walkway shall be clean and dry. Place chalk lines on deck sheet to indicate location of Walkway. Apply a continuous coat of 2170 adhesive to the deck sheet and the back of Walkway in accordance with manufacturer's technical requirements and press Walkway into place with a waterfilled, foam-covered lawn roller. Clean the deck membrane in areas to be welded. Hot-air weld the entire perimeter of the Walkway to the membrane deck sheet. Check all welds with a rounded screwdriver. Re-weld any inconsistencies. Important: Check all existing deck membrane seams that are to be covered by Walkway with rounded screwdriver and re-weld any inconsistencies before Walkway installation. Do not run Walkway over Bars.

3.14 TEMPORARY CUT-OFF

A. All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses. All temporary waterstops shall be constructed to provide a 100% watertight seal. The stagger of the insulation joints shall be made even by installing partial panels of insulation. The new membrane shall be carried into the waterstop. The waterstop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing. The edge of the membrane shall be sealed in a continuous heavy application of sealant as described in Section 2.10. When work resumes, the contaminated membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc. shall be removed from the work area and properly disposed of off site. None of these materials shall be used in the new work.

- B. If inclement weather occurs while a temporary waterstop is in place, the Applicator shall provide the labor necessary to monitor the situation to maintain a watertight condition.
- C. If any water is allowed to enter under the newly-completed roofing, the affected area shall be removed and replaced at the Applicator's expense.

3.15 <u>COMPLETION</u>

- A. Prior to demobilization from the site, the work shall be reviewed by the Owner's Representative and the Applicator. All defects noted and non-compliances with the Specifications or the recommendations of the manufacturer shall be itemized in a punch list. These items must be corrected immediately by the Applicator to the satisfaction of the Owner's Representative and the manufacturer prior to demobilization.
- B. All Warranties referenced in this Specification shall have been submitted and have been accepted at time of contract award.

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SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified and as necessary to comply with the Contract Documents, including, but not limited to, these major items:

- A. All metal wall flashings, related flashing, coping and caps.
- B. Flashing at curbed openings, and other miscellaneous areas where indicated on the drawings.
- C. Flashing flanges for roof drains and overflows.
- D. Flashing at parapet walls that receive roofing membrane.
- E. Flashing and metal covers at mechanical equipment platforms.
- F. Gutters and downspouts.
- G. Rain Water Leaders, Collectors and Scuppers.
- H. Shop and field priming, shop painting, galvanizing, screening, caulking, anchors and anchor straps, clips, etc.
- I. Shop drawings of all sheet metal work including expansion joints.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

- A. Verify drawing dimensions with actual field conditions. Inspect related work and adjacent surfaces.
- B. Report to the Architect all conditions that prevent proper execution of this work.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Shop Drawings: submit: all information required for fabrication, finishing and installation of

this work in complete details.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide in accordance with Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Contractor guarantees the work covered by this specification against all defects in material and workmanship for a period of not less than five (5) years from the date the Owner records Notice of Completion.

PART 2 – PRODUCTS

2.01 <u>MATERIALS</u>

- A. Galvanized Sheet Metal: Conform to ASTM A525, thickness indicated or specified, but not less than 24-gauge. Zinc coating shall weigh not less than 1-1/2 ounces, or more than 1-1/2 ounces per square foot of surface covered.
- B. Solder: Standard Grade-A brand of 50:50 Alloy Lead-Tin, complying with ASTM B32. Name of manufacturer and grade designation shall be cast or die-marked on each bar.
- C. Solder Flux: Raw muratic acid for galvanized metal and zinc; resin for tin, lead, and tinned copper; and non-corrosive soldering salts for uncoated copper.

- D. Sheet Metal Fasteners: Rivets, nails, sheet metal screws, self-tapping screws, and stove bolts, of the type and size best adapted to the condition of use. Provide fasteners of the type specified or indicated.
 - 1. Use: galvanized steel, cadmium-plated steel or 300 Series alloy stainless steel.
 - 2. Pop rivets may be used for metal-to-metal connections when future disassembly is not required. Open-end type may be used for all applications except where watertight connections are required, in which case, use closed end type.
- E. Caulking Compound: Provide as specified under Section 07 90 00. Apply as recommended by the manufacturer; caulking compound of proper consistencies for gun and knife application as necessary.
- F. Shop Prime Coat: Rust-Oleum Corporation. Apply #3202 to 1/2 mil wet coating thickness, #3268 to 1-mil dry coating thickness or provide primer as specified under Section 09 90 00.
- G. Shop Color Coat: Pre-coat in shop with coating of color to match adjoining surfaces.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the Work.
- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Beginning of installation means acceptance of conditions.

3.02 FABRICATION AND ASSEMBLY

- A. Workmanship: Fabricate and finish metal work in a first class manner in accordance with best trade practices with all joints and corners accurately machined, filed and fitted, and rigidly framed together and connected. Carefully match components to produce perfect continuity of line and design. Make joints and connections in exterior face metal watertight, using approved scaling materials and methods of assembly. Fit faces of metal in contact with hairline joints, except as otherwise indicated or required for expansion or fitting. Conceal fastenings, unless otherwise indicated. Conceal required reinforcements within the finished assembly.
- B. Expansion and Contraction: Form and fabricate work to adequately provide for thermal expansion and contraction and building movement in the completed work, without overstressing the materials, breaking connections, or producing wrinkles and distortion in finished surfaces. Finish sheet metal work water and weathertight throughout.
- C. Attachment Clips: Where subject to thermal expansion and contraction, attach members with clips to permit movement without damage to the installation, or provide slotted or over-size holes with washers where appearance is not critical, as approved by the Architect.
- D. Lock Seams: Make lock seam work flat and true to line; sweat full of solder except where installed to permit expansion and contraction. Lap flat lock seams, and lap seams where soldered, according to pitch but in no case less than 4". Make seams in direction of flow. Fill expansion joints with sealant. Plane surfaces shall be free of buckles. Provide reinforcement as necessary. Cleat and fasten substantially on approximately eight-inch centers. All cap flashing and gutter seams to be flat lock seams.
- E. Soldering: Thoroughly clean and tin material prior to soldering. Solder with heavy coppers of blunt design, properly tinned before use. For flat seam work they shall not weight less than ten pounds per pair, and for other work not less than size pounds per pair. Solder slowly with well-heated coppers, heating the seams thoroughly and completely filling them with solder.

Finish surfaces neatly, full flowing and smooth. Wash acid flux thoroughly with a soda solution after soldering and completely remove soldering flux on exposed surfaces.

- F. Welding: Conform to the requirements of AWS "Standard Code for Arc and Gas Welding". Perform welding in a manner resulting in strong, durable, tight, flush, smooth, and clean joints. Weld sheet steel to produce full and complete fusion welds without inducing locked-in stresses in the metal or surface distortions. Welding on exposed surfaces shall be ground smooth and flush and finished to match adjacent surfaces.
- G. Caulking: Where indicated, caulk joints in sheet metal work and between sheet metal work and adjacent construction with polysulfide sealing compound. Apply in accordance with Caulking and Sealants Section.
- H. Coping: Shall be attached to top of parapets in strict conformance with the latest written specifications of the Sheet Metal Industry Fund of Los Angeles, and as indicated on the drawings.
- I. All sheet metal work shall be examined carefully the Contractor, Owner and Architect and if necessary, tested. The Contractor shall make all repairs to damaged items as a result of this testing, leaving them in a condition satisfactory to the Architect.

END OF SECTION

SECTION 07 84 00

FIRE STOPPING

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Work included: Provide firestopping where indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. It is the intent of this section of the specifications to establish a single, competent source to be responsible for providing all labor, materials, products, equipment and services, to supply and install the firestopping and smoke seal work for the entire project, at the following locations, as indicated on the drawings:
 - 1. Openings in fire rated walls, floors and roofs both empty and those containing penetrations such as cables, conduits, cable trays, pipes, ducts and similar penetrating items.
 - 2. Gaps between fire-rated floor slabs and exterior curtain walls.
 - 3. Gaps between fire-rated walls and exterior curtain walls.
 - 4. Gaps located within expansion joints.
 - 5. Gaps between the tops of fire rated walls and underside of fire rated floor or roof assemblies.
 - 6. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
 - 7. Openings at each floor level in fire rated shafts or stairwells.
- C. System Description:
 - 1. Firestopping Materials: Provide firestopping system(s) of sufficient thickness, width and density to provide and maintain a fire resistance rating, as indicated on drawings and in accordance with UL.
 - 2. Provide a seal completely filling all annular spaces to prevent the passage of flame, smoke and gases through the opening in the fire separation in which it is installed.
 - 3. Material Compatibility: Provide materials which are compatible with all materials used in the system including materials used in or on penetrating items as well as all construction materials used in conjunction or contiguous with the system.
 - 4. Accessories: Provide components for each firestopping system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire resistance rated systems. Accessories include but are not limited to the following items:
 - a. Permanent forming/damming/backing materials
 - b. Temporary forming materials
 - c. Substrate primers

- d. Collars
- e. Steel sleeves
- D. Related Work:
 - 1. Openings through Floors and Walls:
 - a. Fire Rated: Metal sleeves for fire rated openings through floors and walls shall be provided under applicable mechanical and electrical specification sections.
 - b. Non-Rated: Non-rated openings through floors and walls shall be sealed under applicable mechanical and electrical specification sections.
 - 2. Firestopping and smoke seals within mechanical (i.e. inside ducts, dampers) and electrical assemblies shall be sealed under applicable mechanical and electrical specifications sections and only in accordance with the equipment or device manufacturers' installation instructions. Firestopping and smoke seals around outside of such mechanical and electrical assemblies, where they penetrate fire rated separations, are the responsibility of this section.

1.03 STANDARDS AND REFERENCES

- A. General:
 - 1. ASTM E814 Test Method of Fire tests of Through Penetration Firestops.
 - 2. ANSI/UL 1479 Fire Tests Of Through-Penetration Firestops
 - 3. ANSI/UL 2079 Standard for Tests for Fire Resistance of Building Joint Systems
 - 4. ASTM E1966 Standard Test Method for Fire-Resistive Joint Systems
 - 5. ASTM E2307 Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-Story Apparatus
 - 6. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials
 - 7. ASTM C616 Standard Specification for Mineral Fiber Block and Board Thermal Insulation
 - 8. UL 2079 Standard Test Method for Fire Resistance of Building Joint Systems
 - 9. UL: Fire Resistance Directory, Volume 2.
 - 10. ITS: Directory of Listed Products.
 - 11. Factory Mutual, Approvals Guide
- B. Regulatory Requirements
 - 1. Conform to applicable local Building Codes for fire resistance ratings.
 - 2. Provide materials, accessories and application procedures which have been listed by UL, or as tested by a nationally recognized independent testing agency in accordance with ASTM E814, ANSI/UL 1479, or ANSI/UL 2079 to achieve the required fire protection rating(s).
- C. Environmental requirements:
 - 1. Do not proceed with the installation of firestopping materials when temperatures or weather conditions exceed the manufacturer's recommended limitations for installation.
 - 2. Ventilate solvent based and moisture-cure firestopping per firestopping manufacturer's instructions by natural means or, where this is inadequate, by forced air circulation.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products of this Section with minimum ten (10) years documented experience, and having a quality management system that is registered as conforming to the requirements of ISO9001.
- B. Applicator: Company having a minimum of three (3) years of experience in the installation of materials specified herein on projects comparable to this project. The firm shall have the written authorization of the firestopping material manufacturer(s).

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Manufacturer's Data: Submit manufacturer's specifications, installation instructions and product data for each material required. Include [UL], [WH], or [FM] tested systems or designs to show compliance with the Contract Documents.
- D. Shop Drawings: Submit shop drawings showing typical installation details including reinforcement, anchorage, fastenings and method of installation for each type of firestopping condition.
- E. Samples: If requested, submit samples of each type of firestopping systems, smoke seals and accessories. Indicate location where material/system shall be utilized.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Deliver materials to Site in manufacturer's sealed and labelled containers or packaging intact. Handle and store materials in accordance with manufacturer's instructions.

1.08 PROJECT CONDITIONS

- A. Comply with manufacturer's recommended requirements for temperature, relative humidity and substrate moisture content during application and, if required, curing of materials.
- B. Do not install firestopping system(s) until Work within opening has been completed. Coordinate with other applicable Sections. Schedule work of other trades so that firestopping applications can be inspected prior to being covered by subsequent construction.

1.09 OPERATION AND MAINTENANCE DATA

Not required.

1.10 EXTRA MATERIALS

Not required.

1.11 RECORD DRAWINGS

Not required.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Provide firestopping silicone sealants, water-based sealants, intumescent sealant, mortars, mineral wool, or firestop devices from the following manufacturers:

- A. Basis of Design: A/D Fire Protection Systems Inc. Tel: (800) 263-4087. Website: www.adfire.com
- B. Owens Corning Thermafiber. Tel: (800) 294-7076. Website: www.thermafiber.com
- C. Or Architect approved equal.

2.02 MATERIALS

- A. Provide a complete system of asbestos-free firestop systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of [ASTM E814], [ANSI/UL 1479], or [ANSI/UL 2079] and listed by [UL], [WH], or [FM] and in addition are approved by jurisdictional authorities and the Consultant.
- B. A/D FIRE BARRIER Silicone Sealants: For use in: openings with penetrating items subject to high movement; multiple penetration systems; for combustible pipes up to 2-in. diameter; in control joints; in curtain wall joints; expansion joints; floor/wall joints; wall/wall joints; head of wall joints; and as a sealant for smoke barrier construction.
- C. A/D FIRE BARRIER Intumescent Caulk: For general use as a firestop sealant with: insulated pipes; pipes; electrical cables and conduit; ducts.
- D. A/D FIRE BARRIER Seal and Seal NS: Water based firestop sealants for use with: control joints; head of wall joints; floor/wall joints; wall/wall joints; multiple penetration systems; plumbing; mechanical; electrical; and where sprayed sealant application is required or desired.
- E. A/D FIRE BARRIER Mortar: For use in: large openings; static non-moving penetrations such as cable trays; for multiple penetration systems; electrical and communication bundles; conduits; non-combustible sleeves; and insulated pipes.
- F. A/D FIRE BARRIER Collars: For use in openings with single combustible pipe penetrations greater than 2-in. diameter.
- G. A/D FIRE BARRIER Pillows: For use in openings with: cable tray; multiple cable penetrations; where retrofitting of penetrating items is anticipated, and as a temporary fire stop system.
- H. Thermafiber Safing: For use in fire and smoke protection in perimeter fire containment systems between fire-rated floor slabs and exterior curtain walls, between fire-rated walls and exterior curtain walls, in floor and wall penetrations, construction joints, and other firestopping applications.

- Thermafiber TopStop: For use in Head-of-Wall construction between metal fluted floor/roof deck and top of fire-rated wall construction. For trapezoidal shaped flutes measuring 2" – 7" wide and depths up to 3".
- J. Fire stop system ratings: Comply with applicable Building Code requirements for locations and ratings.

2.03 ACCESSORIES

- A. Damming and backup materials, supports and anchoring devices: Non-combustible, to manufacturer's recommendations and in accordance with the tested system being installed as acceptable to jurisdictional authorities.
- B. Primers: As required by firestopping manufacturer and compatible with selected system and contiguous materials.
- C. Water: Potable.
- D. Firestopping for vertical (wall) applications: Non-sag caulk or spray grade sealants, Mortar, Collars or Pillows.
- E. Firestopping for horizontal (floor) applications: Non-sag caulk or self-levelling or spray grade sealants, Mortar, Collars or Pillows.
- F. Firestopping for overhead applications: Non-sag caulk or spray grade sealants or Mortar.
- G. Safing Clips: Z-shaped clips formed from galvanized steel.
- H. Tape: Pressure sensitive masking tape as recommended by the firestopping manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Examine substrates, openings, voids, adjoining construction and conditions under which the Work is to be installed. Confirm compatibility of surfaces scheduled to receive firestopping.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Verify that penetrating elements are securely fixed and properly located with the proper space allowance between penetrations and surfaces of openings.
- E. Do not proceed with Work until unsatisfactory conditions are corrected.
- F. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

- A. Surfaces to receive firestopping shall be free of dirt, dust, grease, oil, rust, loose materials, form release agents, frost, moisture or any other matter which would impair the bond of firestopping material to the substrate of penetrating item(s).
- B. For sealants and caulks, prime substrates in accordance with manufacturer's written instructions or recommendations. Confine primers to areas of bond; do not allow spillage or migration onto exposed surfaces.
- C. Do not apply firestopping and smoke seals to surfaces previously painted or treated with sealers, curing compounds, water repellent or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- D. Ensure that anchoring devices, back-up materials, clips, sleeves, supports and other related materials used in the actual fire tests are provided.

- E. Mask where necessary to prevent firestopping materials from contacting adjoining surfaces that will remain exposed upon completion of Work. Remove tape as soon as it is possible to do so without disturbing firestopping seal with substrates.
- F. Installation is not to proceed until submittals have been completed.

3.03 INSTALLATION

- A. Manufacturer's Instructions: Comply with [UL], [WH] or [FM] Listings and manufacturer's instructions for the type of material and condition of opening in each case. Consult with the manufacturer's technical representative to determine proper procedure for conditions not fully covered by printed instructions. Record in writing any oral instructions received, with copy to manufacturer.
- B. Install firestopping with sufficient pressure to properly fill and seal openings to ensure an effective smoke seal. Tool or trowel exposed surfaces. Remove excess firestopping material promptly as the Work progresses and upon completion.
- C. Damming: Provide leak-proof dams as required to seal openings and contain liquid sealants, putty or mortar until cured. Install damming in accordance with manufacturer's instructions.
- D. Damming Boards: Install forming/damming materials and other accessories of type required to support fill materials during their application and in the position needed to produce the shapes and depths required to achieve fire ratings of through-penetration fire stop systems.
 - 1. Combustible Type: For temporary dams only. Remove after firestopping material has cured.
 - 2. Non-Combustible Type: For temporary or permanent dams. Provide non-combustible type wherever damming material cannot be removed after applying firestopping materials.
- E. Void Filler: Use materials recommended by the firestopping manufacturer to seal gaps created by non-combustible type damming boards and to seal around cables, conduits, pipes and where void filler material becomes part of the fire rated assembly.
- F. Sealant: Install damming material or mineral wool as required. Apply sealant so air voids are not present and sealant is in full contact with penetrating items. Tool sealant to ensure substrate contact. Remove excess sealant in accordance with manufacturer's recommendations.
- G. Mortar: Install damming material as required. Mix mortar in strict accordance with manufacturers instructions. Pump, trowel or hand pack mortar through openings to minimum thickness as recommended by manufacturer and as listed by [UL], [WH] or [FM], to achieve required fire rating.
- H. Firestopping Mineral Wool: Install firestopping by compressing material to the minimum required by [UL], [WH] or [FM] listing. Apply firestopping in sufficient thickness, depth and density so as to achieve the required fire resistance rating. Use impaling or safing clips to support and secure firestopping where required by tested system.

3.04 FIELD QUALITY CONTROL

- A. Notify Consultant when completed installations are ready for inspection prior to concealing or enclosing an area containing firestopping materials.
- B. Arrange for inspections by the Owners independent inspection and testing company, appointed and paid for by Owner.
- C. Following field inspections, provide all repair as required to ensure compliance with the Contract Documents.

3.05 CLEANING AND PROTECTION

A. Upon completion of this work, remove all materials, equipment and debris from the site.

- B. Leave work area and adjacent surfaces in a condition acceptable to the Consultant.
- C. Leave installed work with sufficient protection to enable it to remain untouched until project turnover.

END OF SECTION

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SECTION 07 90 00

JOINT PROTECTION

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK

- A. Supply and install all Joint Protection, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Work included: Throughout the work, seal and caulk joints where shown on the Drawings and elsewhere as required to provide a positive barrier against passage of moisture and passage of air.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

- A. Conform to Sealant and Waterproofers Institute requirements for materials and installation.
- B. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
- C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Submit product data:
 - 1. For each sealant product indicated provide manufacturer's technical data, tested physical and performance properties, dimensioned drawings, and other data needed to prove compliance with the specified requirements.
 - 2. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
- D. Samples:
 - 1. Samples for Initial Selection: Three color charts showing manufacturer's standard

range of colors available for each product exposed to view.

2. Samples for Verification: Three strips of cured sealants 1/2 inch by 6 inch (13mm diameter by 150 mm.

1.07 DELIVERY, STORAGE AND HANDLING

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Deliver products in original factory packaging bearing identification of product, manufacturer, and batch number. Provide Safety Data Sheets for each products.
- D. Store products in a location from freezing, damage, construction activity, precipitation, and direct sunlight per manufacturer's recommendations.
- E. Condition products to approximately 60 degrees F (16 degrees C) to 70 degrees F (21 degrees C) for use per manufacturer's recommendations.
- F. Handle products with appropriate precautions and care as stated on Safety Data Sheet.

1.08 PROJECT CONDITIONS

A. Do not use products under conditions of precipitation, or in inclement or freezing weather. Verify that substrates are clean, dry and frost-free. Use appropriate measures for protection and supplementary heating to ensure proper curing conditions per manufacturer's recommendations if application during inclement weather occurs.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

Not required.

1.11 RECORD DRAWINGS

Not required.

1.12 WARRANTY

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. The guarantee specified herein shall include warranties against leakage, hardening, cracking, crumbling, melting, running, shrinking or staining adjacent surfaces.
- E. Contractor Guarantee: Contractor guarantees the work covered by this specification against all defects in material and workmanship for a period of not less than five (5) years from the date of Substantial Completion.

PART 2 – PRODUCTS

2.01 SEALANTS

- A. Except as specifically otherwise accepted by the Architect, use only the types of sealants described as follows:
 - One component polyurethane sealant, moisture curing, low modulus, FS TT-S-0023OC, Type II, Class A, ASTM-C-920, Class 50, for vertical and horizontal joints in connection with all building materials. Do not use in traffic areas. Minimum ¹/₄" joint; maximum 1-1/4" x 3/8"d.
 - a. Dymonic 100 by Tremco
 - b. MasterSeal NP1 by BASF Master Builders
 - c. DynaTrol I-XL Hybrid by Pecora Corporation
 - One-part silicone sealant, moisture curing, low modulus, FS TT-S-0023OC, Type II, Class A, FS TT-S-001543A, Class A, for vertical and horizontal joints in connection with aluminum, glass and concrete materials which require greater movement capabilities. Do not use in traffic areas. Minimum joint ¼" x 3/16"d; maximum1" x ½"d.
 - a. Spectrem 1 by Tremco
 - b. Dowsil 790 by Dow
 - c. 890NST Silicone by Pecora Corporation
 - 3. One-part silicone sealant, medium modulus, neutral cure, FS S-0023OC, Type II, Class A, FS TT-S-001543A, Type II, Class A, ASTM C920, Class 50, for vertical and horizontal joints in connection with non-porous surfaces such as aluminum, glass, tile, laminated plastic and concrete. Do not use in traffic areas.
 - a. Spectrem 2 by Tremco
 - b. Dowsil 795 by Dow
 - c. 895NST Silicone by Pecora Corporation
 - 4. Multi-Component polyurethane sealant, FS TT-S-00227E, Type I, Class A, ASTM C920 for horizontal joints in traffic areas. Minimum 3/8" wide, depth to be 3/8" to ½" use primer.
 - a. THC-901 by Tremco
 - b. DynaTrol II-SG or Dynatred by Pecora Corporation
 - 5. One-part translucent silicone sealant, medium modulus, neutral curing, FS TT-S-0023OC, Type II, Class A, FS TT-S-001543A, Type II, Class A, for vertical joints in connection with butt glazing.
 - a. 895 NST by Pecora
 - b. SCS2800 Silglaze II by Momentive
 - One-part mildew resistant silicone sealant meeting requirements of FDA Regulation 21 CFR 177.2600, for vertical and horizontal joints in connection with non-porous applications as sealing around bathroom fixtures, shower-tub enclosures, sinks and urinals.
 - a. Dowsil 786 by Dow
 - b. SCS1700 Sanitary by Momentive
 - c. 898NST Silicone or 860 Silicone by Pecora Corporation

- 7. One-part siliconized acrylic latex polymer caulk, ASTM C834, for interior horizontal and vertical joints in connection with window and door buck perimeters, interior wall surfaces, etc.
 - a. AC-20 + Silicone by Pecora
 - b. Acrylic Latex by Tremco
- 8. Security Sealants (If applicable to Project)
 - a. One part, non-sag, tamper resistant security sealant, FS TT-S-00230C, Type II, Class B, ASTM C920 for doors and windows.
 - i. DynaFlex SC by Pecora
 - ii. MasterSeal CR 195 by BASF Master Builders.
 - b. Multi-component, rigid, high-solids, high modulus epoxy resin security sealant, ASTM C881, Type I and III, Grade 3, Classes B & C for fixed fixtures including tables, beds, plumbing fixtures, etc.
 - i. DynaPoxy EP-1200 by Pecora
 - ii. Sikadur -31 BY Sika USA
- 9. Roof Penetrations: Use asphalt mastic conforming to ASTM D491.
- 10. For other services, provide products especially formulated for the proposed use and accepted in advance by the Architect.
- B. Colors:
 - 1. The Architect will select Colors for each sealant installation to match adjacent finishes from a standard color list normally available from the specified manufacturers.
 - 2. Should a matching standard color not be available from the accepted manufacturer except at additional charge, the Contractor shall provide such colors at no additional cost to the Owner.
 - 3. In concealed installations, and in partially or fully exposed installations where so accepted by the Architect, use standard gray or black sealant.

2.02 PRIMERS

Use only those primers that are: non-staining, have been tested for durability on the surfaces to be sealed, and are specifically recommended for this installation by the manufacturer of the sealant used.

2.03 BACKUP MATERIALS

- A. Use only those backup materials that are specifically recommended for this installation by the manufacturer of the sealant used, which are non-absorbent, and which are non-staining.
- B. Acceptable types include:
 - 1. Closed-cell resilient urethane or polyvinyl chloride foam;
 - 2. Closed-cell polyethylene foam;
 - 3. Closed-cell sponge of vinyl or rubber;
 - 4. Polychloroprene tubes or beads;
 - 5. Polyisobutylene extrusions;
 - 6. Oil-less dry jute.
- C. Preformed support strips for ceramic tile control joint and expansion joint work: Use polyisobutylene or polychloroprene rubber.

2.04 BOND-PREVENTATIVE MATERIALS

Use only one of the following as best suited for the application, and as recommended by the manufacturer of the sealant used:

- 1. Polyethylene tape, pressure-sensitive adhesive, with the adhesive required only to hold tape to the construction materials as indicated;
- 2. Aluminum foil complying with MIL-A-148E;
- 3. Wax paper complying with Fed. Spec. UU-P-270.

2.05 JOINT PACKING

Shall be installed in all joints to receive sealant. Material shall be a resilient type such as closed cell PVC foam or as recommended by the manufacturer. Oakum or other types of absorptive materials shall not be used as packing material.

2.06 OTHER MATERIALS

- A. For masking around joints, provide masking tape complying with Fed. Spec. UU-T-106c.
- B. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the acceptance of the Architect.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

- A. Concrete and ceramic tile surfaces:
 - 1. Install only on surfaces that are dry, sound, and well brushed, wiping free from dust.
 - 2. At open joints, remove dust by mechanically blown compressed air if so required.
 - 3. Use solvent to remove oil and grease, wiping the surfaces with clean rags.
 - 4. Where surfaces have been treated, remove the surface treatment by sandblasting or wire brushing.
 - 5. Remove laitance and mortar from joint cavities.
 - 6. Where backstop is required, insert the approved backup material into the joint cavity to the depth needed.
- B. Steel surfaces:
 - 1. Steel surfaces in contact with sealant:
 - a. Sandblast as required to achieve acceptable surface for bonding.
 - b. If sandblasting is not practical, or would damage adjacent finish, scrape the metal or wire brush to remove mill scale.
 - c. Use solvent to remove oil and grease, wiping the surfaces with clean rags.
 - 2. Remove protective coatings on steel by sandblasting or by using a solvent that leaves

no residue.

- C. Aluminum surfaces:
 - 1. Remove temporary protective coatings, dirt, oil, and grease.
 - 2. When masking tape is used for protective cover, remove the tape just prior to applying the sealant.
 - 3. Use only such solvents to remove protective coatings as are recommended for that purpose by the manufacturer of the aluminum work, and which are non-staining.

3.03 INSTALLATION OF BACKUP MATERIAL

- A. Use only the backup material recommended by the manufacturer of the sealant used, and accepted by the Architect for the particular installation, compressing the backup material 25% to 50% to achieve a positive and secure fit.
- B. When using backup of tub or rod stock, avoid lengthwise stretching of the material. Do not twist or braid hose or rod backup stock.
- C. Interior and exterior joints where no backing has been provided or which is in excess of 3/4" deep shall be packed by this subcontractor with fiberglass or a suitable joint filler to reduce the depth to 1/2" maximum. Maximum movement: the width of the joint shall be at least four times its maximum movement.

3.04 PRIMING

- A. Use only the primer recommended by the manufacturer of the sealant, and accepted by the Architect for the particular installation, applying in strict accordance with the manufacturer's recommendations as accepted by the Architect.
- B. The priming of joints shall be by brush to reach all surfaces to which compound will be applied. Primer shall be provided on masonry, concrete and wood surfaces as recommended by sealant manufacturer. Primer shall not be applied to surfaces that will be exposed after caulking is completed.

3.05 BOND-BREAKER INSTALLATION

Provide an approved bond-breaker where recommended by the manufacturer of the sealant, and where directed by the Architect, adhering strictly to the installation recommendations as accepted by the Architect.

3.06 INSTALLATION OF SEALANTS

- A. Prior to start of installation in each joint, verify the joint type according to details on the Drawings, or as otherwise directed by the Architect, and verify that the required proportion of width of joint to depth of joint has been secured.
- B. Equipment:
 - 1. Apply sealant under pressure with power-actuated or hand gun, or by other appropriate means.
 - 2. Use guns with nozzle of proper size, and providing sufficient pressure to completely fill the joints as designed.
- C. Thoroughly and complete mask joints where the appearance of sealant on adjacent surfaces would be objectionable.
- D. Install the sealant in strict accordance with the manufacturer's recommendations as accepted by the Architect, thoroughly filling joints to the recommended depth.
- E. Tool joints to the profile shown on the Drawings, or as otherwise required if such profiles are not shown on the Drawings.

- F. Cleaning up:
 - 1. Remove masking tape immediately after joints have been tooled.
 - 2. Clean adjacent surfaces free from sealant as the installation progresses, using solvent or cleaning agent recommended by the manufacturer of the sealant used.
 - 3. The excess material shall be cleaned from the surfaces adjacent to the joint, following the caulking operation and the top of the compound deposit shall be left with a smooth even finish. No material is permitted on the exposed face of aluminum sections.

END OF SECTION

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SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK

Work under this section comprises of furnishing hollow metal doors and frames, including transom frames, sidelight and window frames with provision for glazed, paneled or louvered openings, fire labeled and non-labeled, as scheduled.

1.03 <u>REFERENCES</u>

- A. Standards:
 - 1. Current NFPA 80 Fire Doors and Window
 - 2. ANSI/SDI-100 Recommended Specifications for Standard Steel Doors an Frames
 - 3. ASTM-F 476 Standard Test Methods for Security of Swinging Doors Assemblies
 - HMMA 862 Guide Specifications for Commercial Security Hollow Metal Doors and Frames
 - 5. SDI-105 Recommended Erection Instructions for Steel Frames
 - 6. SDI-107 Hardware on Steel Doors (reinforcement application)
 - 7. ANSI-A250.4 Steel Doors and Frames Physical Endurance
 - 8. UL10C Standard for Positive Pressure Fire Tests of Door Assemblies
 - 9. UL752 Ballistic Standards
- B. Codes:
 - 1. Current NFPA-101 Life Safety Code
 - 2. 2013 CBC California Building Code
 - 3. ANSI-A117.1 Accessible and Usable Building and Facilities
 - 4. Current DOJ ADA Standards for Accessible Design DOJ

1.04 QUALITY ASSURANCE

- A. Manufacturer shall be a member in good standing of the Steel Door Institute (SDI).
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- C. Unless specifically otherwise accepted by the Architect, provide all products of this Section from a single manufacturer.
- D. Fire Rated Door Assemblies:
 - 1. All labeled fire door assemblies to be of a type that have been classified and listed in accordance with the latest edition of NFPA80 and test in compliance with NFPA-252,

and UL10C. A physical label is to be affixed to the fire door at an authorized facility; embossed labels are acceptable on standard 3 sided door frames.

- 2. For openings required to be fire rated exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.
- 3. Project requires door assemblies and components that are compliant with positive pressure and S-label requirements. Specifications must be cross-referenced and coordinated with hardware and other door manufacturers to ensure that total opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.
- 4. Certification(s) of compliance shall be made available upon request by the Authority Having Jurisdiction.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Submit:
 - 1. List of items that will be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
 - 4. Provide a schedule of doors and frames using same reference numbers for details and door openings as those on the contract documents.
 - 5. Submit shop drawings. Shop drawings should include the following information:
 - a. Material thickness and/or gauge.
 - b. Door core material.
 - c. Mortises and reinforcements.
 - d. Anchorage types.
 - e. Locations of exposed fasteners.
 - f. Glazed, louvered and paneled openings.
 - g. Mounting locations of standard hardware

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 – Services, Materials and Equipment.

- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. The supplier shall deliver all materials to the project site; direct factory shipments are not allowed unless agreed upon beforehand. Supplier shall coordinate delivery times and schedules with the contractor.
- D. Deliver doors cardboard wrapped or crated to provide protection during transit and jobsite storage. Provide additional protection to prevent damage to any factory-finished doors. Mark all doors and frames with opening numbers as shown on the contract documents and shop drawings.
- E. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the architect. Otherwise, remove and replace damaged goods as directed.
- F. Store doors and frames at the building site in a dry and secure place.
 - 1. Place units on minimum 4" high wood blocking.
 - 2. Avoid use of non-vented plastic or canvas shelters that could create a humidity chamber.
 - 3. If cardboard wrapper on door becomes wet, remove carton immediately.
 - 4. Provide 1/4" spaces between stacked doors to promote air circulation.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 <u>WARRANTY</u>

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Warranties listed in this Section shall be in addition to, and not a limitation of other rights the owner may have under the contract documents.
- E. All doors and frames shall be warranted in writing by the manufacturer against defects in materials and workmanship for a period of two (2) years commencing on the date of final completion and acceptance.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements, provide standard hollow metal doors and frames by one of the following or Architect approved equal:

- A. Security Metals
- B. Door Components
- C. Ceco Corporation
- D. Curries Company
- E. Steelcraft Company

2.02 MATERIALS

- A. All doors and frames shall be manufactured of commercial quality cold rolled steel per ASTM-A366 and A568 general requirements; galvanized to A60 or G60 or galvanealed to A40 minimum coating weight standard per ASTM-A924. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A569
- B. Supports and anchors shall be fabricated of not less than 18-gauge sheet steel, galvanized where galvanized frames are used.
- C. Where items are to be built into exterior walls, inserts, bolts and fasteners shall be hot dipped galvanized in compliance with ASTM-A153, Class C or D as applicable.
- D. Rust inhibitive enamel or paint primer shall be used, baked on, and suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces on Steel Doors and Frames."
- E. Where specified supply embossed steel doors with wood grain appearance. Wood grain shall follow the pattern of a stile and rail wood door with both vertical and horizontal grain patterns. Doors with vision lites are required to have wood grain window kits.
- F. Finish: See Door & Hardware Schedule and Finish Schedules.

2.03 METAL DOORS

- A. Provide 1 3/4" thick doors of materials and ANSI/SDI-100 grades and models specified below, or as indicated on drawings or schedules:
 - 1. Interior Doors: Level 2, Model 2 Seamless

Interior doors shall be minimum 16-gauge steel with both lock and hinge rail edge of door intermittently welded, filled and ground smooth the full height of door. Acceptable Manufacturers/Products:

- a. Ceco: Regent-16-SEM
- b. Curries: 707N-16
- c. Steelcraft: LF16
- d. Architect Approved Equal
- 2. Exterior Doors: Level 3, Model 2 Seamless

Exterior doors shall be minimum 16-gauge galvanized or galvanealed steel with both lock and hinge rail edge of door intermittently welded, filled and ground smooth the full height of door. Exterior doors shall be insulated with a solid slab of expanded polystyrene or polyurethane foam permanently bonded to the inside of each face skin. The top of all doors shall be closed flush by the addition of a 16-gauge screwed-

in top cap and sealed to prevent water infiltration. The bottom channel shall include weep-holes. Acceptable Manufacturers/Products:

- a. Ceco: Legion-16-SEM
- b. Curries: 707N-16
- c. Steelcraft: LF16-Polystyrene
- d. Architect Approved Equal

2.04 METAL FRAMES

- A. Provide hollow metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on the drawings and schedules. Conceal fastenings unless otherwise indicated:
 - 1. Interior Frames: Level 2, 16-gauge.
 - 2. Exterior Frames: Level 2, 16-gauge, galvanized or galvanealed.
- B. Acceptable Manufacturers/Products:
 - 1. Ceco: SU Series
 - 2. Curries: M Series
 - 3. Steelcraft: F Series
- C. All frames over 36" in width shall be 14-gauge.
- D. Fabricate frames with mitered corners. Weld both the inside the throat of the corners and the face of the corners, re-prime at the welded areas. All welds to be flush with neatly mitered or butted material cuts.
- E. All frames shall have minimum 7-gauge hinge reinforcements, 14-gauge lock strike reinforcing, and 12-gauge closer reinforcing.
- F. All frames shall have minimum 7-gauge hinge reinforcements with an additional high frequency 12-gauge hinge reinforcement welded to the top hinge, 14-gauge lock strike reinforcing, and 12-gauge closer reinforcing.
- G. Provide temporary shipping bars to be removed before setting frames.
- H. Except on weather stripped frames, drill stops to receive three (3) silencers on strike jambs of single frames and two (2) silencers on heads of double frames.
- I. Provide minimum 0.0179" thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings

2.05 DOOR LOUVERS

- A. Fire-Rated Louver:
 - 1. Each fire-rated louver shall have the listing mark of Underwriter's Laboratories Inc. affixed to louver assembly.
 - 2. All louvers in fire-rated doors shall be 16-gauge cold rolled steel with stainless steel operating springs.
 - 3. Louvers shall be sight-proof per SDI-111C.
- B. Fixed-Blade Louver:
 - 1. All fixed blade louvers shall be 18-gauge cold rolled steel with mitered and welded frames and countersunk mounting holes.
 - 2. Louvers shall be sight-proof per SDI-111C.

3. Provide insect screen where louver occur in exterior doors.

2.06 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.
 - 1. Clearances shall be no more than 1/8" at jambs and heads except between non fire rated pairs of doors which may be no more than 1/4."
 - 2. Clearances shall be no more than 3/4" at the bottom of the doors.
 - 3. Clearances shall be no more than 1/4" at thresholds and curbs allow unless otherwise detailed.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of non-flush units, from only cold-rolled steel sheet.
 - 1. All doors shall be of types and sizes on the drawings, and shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges. Doors shall be strong, rigid and neat in appearance, free from warpage or buckle. Corner bends shall be true and straight and of minimum radius for the gauge of metal used.
 - 2. Door faces shall be joined at their vertical edges by a continuous weld extending the full height of the door. All such welds shall be ground, filled and dressed smooth to make them invisible and provide a smooth flush surface.
 - 3. Top and bottom edges shall be closed with a continuous recessed 16 gauge steel channel extending the full width and spot welded to both faces. Exterior doors shall have an additional flush closing channel at the top edge. Opening shall be provided in the bottom closer for escape of entrapped moisture.
 - 4. Doors shall be mortised, reinforced, drilled and tapped at the factory for fully template hardware only. Where surface mounted hardware is to be applied, doors shall have reinforcing plates only, with drilling and tapping to be done in the field.
 - 5. The Face sheets of Exterior and Security doors shall be stiffened by continuous vertical formed steel sections occupying the full thickness of the interior space between door faces. These stiffeners shall be not less than 20 gauge, spaced not more than 6" apart and securely attached to both face sheets by spot welds not more than 4" on center. Spaces between stiffeners shall be sound deadened and insulated the full height of the door with an inorganic non-combustible batt-type material.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
 - 1. All door and louver frames shall be strong and rigid, neat in appearance, square, true and free of defects, warp and buckle. Molded members shall be clean cut, straight and of uniform profile and back-bends shall be as detailed.
 - 2. Corner joints shall have all contact edges closed tight, with trim faces and stops mitered and continuously welded. All welds shall be ground, filled and dressed smooth to make them invisible and provide a smooth flush surface.
 - 3. Unit frames for installation in stud partitions shall be provided with steel anchors of suitable design for welding to steel studs. Anchors shall be not less than 16-gauge and shall be securely welded inside each jamb. Anchors are to be spaced at 24" on center.
 - 4. Dust cover boxes of not less than 26-gauge shall be provided at all hardware mortises on frames to be set in masonry or drywall partitions.

- D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- E. Unless otherwise indicated, provide exposed fasteners with countersunk flat or oval heads for exposed screws and bolts.
- F. Labeled doors and frames shall be provided for those openings requiring fire protection ratings, as scheduled on the drawings. Such doors and frames shall be constructed as tested by the Underwriter's Laboratories, Inc., and shall bear their label for the required rating. Provide additional frame accessories as required to maintain the fire protection ratings once the frames are installed in the openings.
- G. At exterior locations and elsewhere as shown or scheduled, assemblies fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies. Unless otherwise indicated, provide thermal-rated assemblies with a minimum U-value rating of 0.41 Btu/sq. ft. x h x deg F.
- H. Where shown or scheduled, provide door and frame assemblies fabricated as soundreducing type, tested according to ASTM E 1408, and classified according to ASTM E 413. Unless otherwise indicated, provide acoustical assemblies with STC sound ratings of 33 or better.
- Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI-107 and ANSI-A115 Series specifications for door and frame preparation for hardware.
- J. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site. Provide internal reinforcements for all doors to receive door closers and exit devices.
- K. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
- L. Provide glazing stops with minimum 0.0359-inch- thick steel or 0.040-inch- thick aluminum.
- M. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
- N. Provide screw-applied, removable, glazing beads on inside of glass and other panels in doors.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 FIELD MEASUREMENTS

Verify all opening dimensions in the field prior to fabrication and assembly of frames.

3.03 INSTALLATION

- A. Install steel doors, frames, and accessories according to shop drawings, manufacturer's data, and as specified.
- B. Comply with provisions of SDI-105, "Recommended Erection Instructions for Steel Door Frames," unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - 1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
 - 2. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
 - 3. At existing concrete or masonry construction, install at least 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
 - 4. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel-stud partitions, attach wall anchors to studs with screws.
 - 5. Install fire-rated frames according to NFPA 80.
- C. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100. Install fire rated doors with clearances specified in NFPA 80.

3.04 ADJUST AND CLEAN

- A. Immediately after erection, sand smooth all rusted and damaged areas of prime coat, and apply touch-up of compatible air-drying primer.
- B. Immediately before final inspection, remove protective wrappings from doors and frames.
- C. Final adjustments:
 - 1. Check and readjust operating finish hardware items in hollow metal work just prior to final inspection.
 - 2. Leave work in complete and proper operating condition.
 - 3. Remove defective work and replace with work complying with the specified requirements.

END OF SECTION

SECTION 08 12 16

ALUMINUM DOORS, DOOR FRAMES AND WINDOW FRAMES

PART - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all Aluminum Doors and Frames, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete and proper installation.
- B. Section includes:
 - 1. Flush Panel Aluminum Doors
 - 2. Aluminum-Framed Storefront

1.03 STANDARDS AND REFERENCES

- A. American Architectural Manufacturers Association (AAMA): Comply with applicable provisions for materials, fabrication and installation of component parts.
- B. American Society for Testing and Materials (ASTM)
- C. Aluminum Association (AA)

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility:
 - 1. Obtain entrances, storefronts, ribbon walls, window walls, curtain walls, window systems, and finish through one source from a single manufacturer.
- B. Provide test reports from AAMA accredited laboratories certifying the performances as specified in 1.03.
- C. Performance Requirements for doors:
 - 1. Each assembly tested by a recognized testing laboratory or agency in accordance with specified test methods.
- D. Performance Requirements for frames:
 - 1. Limit air leakage through assembly to 0.06 CFM/min/sq. ft. (.00003 m³/sm²) of wall area at 6.24 PSF (300 Pa) as measured in accordance with ASTM E283.
 - 2. Water Resistance: No water leakage when measured in accordance with ASTM E331 with a static test pressure of 8 PSF(383 Pa).
 - 3. Limit mullion windload deflection of L/175 with full recovery of glazing materials, when measured in accordance with ASTM E 330.
 - 4. System shall not deflect more than 1/8" at the center point, or 1/16" at the center point of a horizontal member, once deadload points have been established.
 - 5. System shall accommodate expansion and contraction movement due to surface temperature differential of 180 degrees F.

- 6. Seismic testing shall conform to AAMA recommended static test method for evaluating performance of curtain walls and storefront wall systems due to horizontal displacements associated with seismic movements and building sway.
- 7. Thermal Performance When tested in accordance with AAMA 1503.1 the following results should be attained: U-Maximum .63/CRF minimum of 59.
- 8. National Fenestration Rating Council (NFRC) specific application evaluation.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.

1.07 DELIVERY, STORAGE AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 <u>WARRANTY</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 <u>MANUFACTURERS</u>

- A. Basis of Design: Arcadia, Inc., 3225 East Washington Blvd., Vernon, CA. Telephone 323/269-7300, Fax 323/269-7390.
- B. Or Architect approved equal.

2.02 DOOR MATERIALS AND ACCESSORIES

- A. Basis of Design: Model RP325 Series Flush Panel Entrance, 1-3/4". Door stiles, rails shall have a nominal .125" wall thickness.
- B. Door and glazing members: Extruded 6063-T6 alloy (ASTM B221-Alloy G.S. 10a T6), for 1/4-inch or 1-inch infill.
- C. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc plated steel in accordance with ASTM A-164. Providing the steel is properly isolated from aluminum.
- D. Plain unpatterned 5005 alloy aluminum sheet .060 through .125 inches thick.
- C. Hardboard backing shall be 1/8-inch tempered hardboard.
- D. Core filled with an isocyanurate rigid foam board.
- E. Louvers blade and frame shall be 6063-T6 aluminum alloy.
 - 1. Louver blade inverted "Y" type shall have a minimum of 50 percent free airflow
- G. Insect Screens: 18-16 mesh, 0.011-inch dia. Aluminum, set in 6063-T6 extruded aluminum alloy frame, 0.05-inch min thickness
- H. Glazing Gasket (compression-type design).

2.03 DOOR HARDWARE

A. Refer to Section 08 71 00 for Door Hardware.

2.04 DOOR FABRICATION

- A. Door sections to receive and conceal cut edges of face sheets.
- B. Face sheets lap and interlock stiles and rails.
- C. Prepare internal reinforcement for door hardware.
- D. Custom hardware templates and physical hardware must be submitted prior to any fabrication.

2.05 FRAMING MATERIALS AND ACCESSORIES

- A. Basis of Design: Model AG451T Series, 2" x 4-1/2" thermally broken, center glazed system, screw spline, shear block, compensating stick or punched opening fabrication for 1" glass.
- B. Framing members, transition members, mullions, adaptors, and mounting: Extruded 6063-T6 aluminum alloy (ASTM B221 Alloy G.S. 10a T6).
- C. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zincplated steel in accordance with ASTM.A-164. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from aluminum.
- D. Glazing Gasket
 - 1. Compression-type design, replaceable, molded or extruded, or ethylene propylene diene monomer (EPDM).

2. Shall be of type that locks securely into the glazing reglet to prevent glazing gaskets from disengaging.

2.06 FRAMING SYSTEM FABRICATION

- A. Continuous sub-sill shall be provided under sill members to collect water infiltration and divert from the interior of the system.
- B. Framing members shall be internally reinforced and secured at head and sill as necessary for structural performance requirements, for hardware attachment, and as indicated.
- C. Fasteners shall be so located as to ensure concealment from view in the final assembly.

2.07 <u>FINISH</u>

- A. Finish all exposed areas of aluminum and components as indicated.
 - 1. An Architectural Class II or 1 color anodic coating conforming with AA-M12C22A34/AAM12C22A44.
 - a. Anodized finish color shall be Colornodic: As indicated in the Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions and verify substrate conditions are acceptable for product installation.
- B. Notify the Construction Manager and Architect in writing of any conditions detrimental to the proper and timely completion of the installation.
- C. Correct conditions detrimental to timely and proper complete of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

A. Install in accordance with approved shop drawings and manufacturers installation instructions.

3.03 FIELD QUALITY CONTROL

- A. Test the storefront for water leaks in accordance with AAMA 501.2. Conduct test in the presence of the Architect. Correct deficiencies observed as a result of this test.
- B. Contractor's responsibility to make all necessary final adjustments to attain normal operation of each door and its mechanical hardware.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all Wood Doors, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section Includes:
 - 1. Prefinished standard and fire rated type wood doors with flush faces.
 - 2. Pre-fit and pre-machine pre-finished wood doors.
- C. Related Sections:
 - 1. Section 06 10 00 Rough Carpentry
 - 2. Section 08 11 00 Metal Doors and Frames
 - 3. Section 08 71 00 Door and Window Hardware
 - 4. Section 08 80 00 Glazing: Glass and glazing for doors.
 - 5. Division 26 Low Voltage Distribution

1.03 STANDARDS AND REFERENCES

- A. American National Standards Institute (ANSI) 1. A115-W 1995, WOOD DOOR HARDWARE STANDARDS Hardware Preparations. 2. A117.1 – 1998, Accessible and Usable Buildings and Facilities.
- B. American Society for Testing and Materials (ASTM) 1. ASTM E 119-00a, Standard Test Methods for Fire Tests of Building Construction and Materials.
- C. Door and Hardware Institute (DHI) 1. Locations for architectural hardware for standard steel doors and frames, 1990. 2. Sequence and format for the hardware schedule, January 1996.
 3. Hardware for Labeled Fire Doors, February 1993 edition. 4. Hardware for Health Care Facilities, June 1983. 5. Abbreviations and Symbols, September 1983.
- D. HPVA Hardwood and Plywood Veneer Association.
- E. International Building Code (IBC 2006)
- F. National Electrical Manufacturers Association (NEMA)
- G. National Fire Protection Association (NFPA) 1. NFPA-80 Standard for Fire Doors and Windows, 2007 edition. 2. NFPA-80A Recommended Practice for Protection of Buildings from Exterior Fire Exposures, 2001 edition. 3. NFPA-101 Life Safety Code, 2006 edition. 4. NFPA-101A Guide on Alternative Approaches to Life Safety, 2001 edition. 5. NFPA-101B Code for Means of Egress for Buildings and Structures, 1999 edition. 6. NFPA-105 Recommended Practice for the Installation of Smoke-Control Door Assemblies, 1999 edition. 7. NFPA-252 Standard Methods of Fire Tests of Door Assemblies, 1999 edition.

- H. Steel Door Institute (SDI) 1. SDI-105-98 Recommended Erection Instructions for Steel Frames. 2. SDI-117-93 Manufacturing Tolerances for Standard Steel Doors and Frames. 3. SDI-122-99 Installation and Troubleshooting Guide for Standard Steel Doors and Frames. 4. SDI-124-98 Maintenance of Standard Steel Doors and Frames.
- Underwriters Laboratories (UL) 1. UL 10C/UBC7-2-97 Fire Tests of Door Assemblies Positive Pressure 2. UL 1784-90 Air Leakage Tests of Door Assemblies 3. Door Assemblies Air Leakage Test (1784-90)
- J. Uniform Building Code (UBC): 1. UBC 7-2 1997, Fire Test of Door Assemblies.
- K. Window and Door Manufacturers Association (WDMA) 1. IS 1-A 2011 Industry Standard for Architectural Flush Wood Doors.

1.04 QUALITY ASSURANCE

- A. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies in accordance NFPA 252 and which are labeled and listed for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
 - Doors: Comply with UBC 7-2 1997 where required. 2. Provide intumescent requirements in compliance with UL-10C Category A or B. 3. Provide doors that comply with UL10C Category B and coordinate with Section 08710 for applied Category G sealing systems. (Architect to choose category A or B)
- B. WDMA I.S. 1-A 2011 Quality Standard: Window and Door Manufacturers Association Quality Standards for grade of door, core, construction, finish, and other requirements.
- C. Temperature Rise Rating: At stairwell enclosures, provide doors which have Temperature Rise Rating of 250 degrees F maximum in 30 minutes of fire exposure.
- D. Supplier Qualifications: Supplier to have a full time Certified Door Consultant (CDC) on staff or some of comparable experience. Supplier shall have warehousing and office facilities within 100 miles of project. Supplier to have been engaged in this type of business in jobsite area for 3 or more years.
- E. Certification of Label Construction: 1. Intertek Testing, Inc. (WHI) 2. Underwriters Laboratories, Inc. (UL) 3. California State Fire Marshal (CSFM)
- F. Substitutions: Apply for substitutions in compliance with the requirements set fourth in Division 1 and no less than 10 business days prior to bid date.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. General Requirements:
 - 1. Scope of work is to provide flush wood doors in compliance with the approved shop drawings, approved finish hardware schedule and approved door and frame schedule.

- 2. Wood doors to meet positive pressure Category A or B requirements (as required by specification).
- D. Shop Drawings and Product Data:
 - 1. Submit in accordance with Section 01 33 00 Submittal Procedures.
 - 2. Indicate general construction, jointing methods, hardware and louver locations, and locations of cutouts for glass. Indicate thickness of veneers.
 - 3. Provide 6 copies of the approved door and frame schedule in the DHI horizontal format with shop drawings.
- E. Schedules:
 - 1. Provide door and frame schedule in the DHI horizontal format. 2. Door and frame schedule to be prepared by a CDC (Certified Door Consultant) or someone of comparable experience.
- F. Product Data:
 - 1. Provide catalog cuts of each item.
- G. Samples:
 - 1. Submit samples of wood veneer and factory finishing in accordance with WDMA Quality Standards I.S. 1-A 2011, sections G-18 and Guide Specifications 1.03 C.
 - 2. Submit 12" x 12" corner sample of each different type of door, .i.e. PC, SCL, FD1.
- H. Wiring Diagrams:
 - 1. Provide riser diagrams for electrified hardware and coordinate with electrical.
 - 2. Show conduit in shop drawings and reference in door and frame schedule.
- I. Operations and Maintenance Data: At date of acceptance provide owner with 1 copy of an owners Operations and Maintenance Manual. This manual is to be a 3 ring loose leaf binder with the project name and address on the front cover and spine. In this manual are to be 1 copy of the following items:
 - 1. As Built Door & Frame Schedule.
 - 2. As Built Shop Drawings.
 - 3. As Built Finish Hardware Schedule.
 - 4. Wood Door Manufacturer's Installation Instructions.
 - 5. Section 08110 Standard Steel Doors and Frames.
 - 6. Section 08210 Flush Wood Doors.
 - 7. Section 08710 Finish Hardware.
 - 8. Each related specification Section.
 - 9. Name, address and phone number of the wood door manufacturer.
 - 10. Name, address and phone number of the local manufacturers representative.
 - 11. Name, address and phone number of the material supplier and contact person.
 - 12. Manufacturers care and maintenance instructions.
 - 13. Executed warranty (s).
 - 14. Manufacturers Safety Data Sheets (MSDS) showing compliance to EPA requirements for lead lined doors and frames.

- 15. Field test data for lead lined doors and frames (to prove EPA compliance).
- J. Certification:
 - 1. Submit certification that doors and frames comply with applicable local codes.
- 1.07 DELIVERY STORAGE AND HANDLING
 - A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
 - B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
 - C. Site Conditions: Storage area for wood doors is to be in a dried, conditioned and secure area with controlled and stabilized humidity per manufacturer's recommendations.
 - D. Marking and Packaging:
 - 1. Doors to be marked per the approved door and frame schedule.
 - 2. Prefinished Doors to have 5 mil plastic peel coat applied to both sides.
 - E. Delivery: Coordinate delivery with Installer not less than 3 weeks prior to delivery.
 - F. Storage:
 - 1. Follow the Care and Installation guidelines as described in WDMA I.S. 1-A 2011.
 - 2. Doors are to be stored flat and palletized with not more than 30 door leafs per pallet.
 - 3. Doors to be a minimum of 6" above floor while in storage.
 - G. Handle doors with clean, white soft cotton gloves to prevent contamination by hand oils and dirt. Gloves are to be provided by whomever handles doors at any given time.
 - H. Handle doors per manufacturer's recommendations.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 <u>RECORD DRAWINGS</u>

Not required.

1.11 WARRANTY

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Guarantee: Provide manufacturer's guarantee for all wood doors. Guarantee period: Lifetime of original installation. Doors exhibiting defects in materials or workmanship including warp and delamination within guarantee period shall be replaced (including hanging and finishing) with new doors. These terms shall be part of the manufacturer's standard warranty.
PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Basis of Design: American Series Flush Doors by ABS Manufacturing 1488 Tillie Lewis Drive – Stockton, CA 95206; 4475 S. Fulton Parkway Building 6 Suite# 200 – Union City, GA 30349; Phone: (888) 4542888; Fax (888) 454-2889.
- B. Eggers Industries, Two Rivers, WI (920)793-1351
- C. Oregon Door, 477 Dillard Gardens Rd., Dillard, OR 97432 (800)-722-7269
- D. Or Architect approved equal.

2.02 MATERIALS

- A. Door Construction
 - 1. Non-Fire Rated Doors: Thickness: 1-3/4 inches, interior flush wood, bonded, solid core conforming to WDMA I.S. 1-A 2011 and the following;
 - a. Core: bonded particle core (PC) or structural composite lumber (SCL) conforming to WDMA I.S. 1-A 2011.
 - b. Door construction shall conform to WDMA I.S. 1-A 2011 Premium Grade requirements.
 - c. Stiles: Hardwood to match face veneer over structural composite lumber (SCL), glued to core. Minimum stile thickness of 1 3/8".
 - d. Rails: Mill option hardwood or SCL. Top and bottom: minimum of 1 1/8" inches.(MDF)
 - e. Facing: Wood veneer as specified.
 - f. Acceptable manufacturers and products: Manufacturer PC Core SCL Core GP Core EX Core American HD-NL EHD-NL STC-43 STC-45 Eggers PC-5 SCL-5 STC-43 STC-45 Oregon PC-5 SCL-5
 - 2. 20 minute Rated Doors: Thickness: 1-3/4 inches, interior flush wood, bonded, solid core conforming to WDMA I.S. 1-A 2004 and the following;
 - a. Core: bonded particle core (PC) or structural composite lumber (SCL) conforming to WDMA I.S. 1-A 2011.
 - b. Door construction shall conform to WDMA I.S. 1-A 2011 Premium Grade requirements.
 - c. Stiles: Hardwood to match face veneer over mineral composite, glued to core.
 - d. Rails: Mineral composite as required by fire door authorities. Top and bottom: as required by manufacturer's fire door authorities.
 - e. Facing: Wood veneer as specified.
 - f. Frame Applied Seals: Provide smoke seals by others as required to meet labeling requirements.
 - g. Acceptable manufacturers and products: Manufacturer 20 min. PC 20 min. SCL American HD- 20B EHD- 20B American HD- 20A EHD- 20A Eggers PC-5 20B SCL-5 20B Eggers PC-5 20A SCL-5 20A Oregon PC-5 20B SCL-5 20B Oregon PC-5 20A SCL-5 20A
 - 3. Fire Rated Doors: Thickness: 1-3/4 inches, interior flush wood, bonded, solid core conforming to WDMA I.S. 1-A 2004 and the following;

- a. Core: bonded mineral core (FD) conforming to WDMA I.S. 1-A 2011.
- b. Door construction shall conform to WDMA I.S. 1-A 2011 Premium Grade requirements.
- c. Stiles: Hardwood to match face veneer over mineral composite, glued to core.
- d. Rails: Mineral composite as required by fire door authorities. Top and bottom: as required by manufacturer's fire door authorities.
- e. Facing: Wood veneer as specified.
- f. Frame Applied Seals: Provide Category G seals by others as required to meet labeling requirements.
- g. Acceptable manufacturers and products: Manufacturer FD 3/4 FD1 FD 1 ½ American MC 45B MC 60B MC 90B American MC 45A MC 60A MC 90A Eggers FD-45B FD-60B FD-90B Eggers FD-45A FD-60A FD-90A Oregon FD-45B FD-60B FD-90B Oregon FD-45A FD-60A FD-90A
- B. Wood Veneer
 - 1. Door face veneers shall meet HPVA "A" grade quality standards conforming to WDMA I.S. 1-A for transparent or semi-transparent finish. Minimum face veneer thickness shall be 1/42" at 12% moisture content after finish sanding.
 - 2. Species: White Oak
 - 3. Face Cut: Plain Sliced, Rift cut
 - 4. Face Assembly: Book Match / Slip Match / Random Match. (TBD)
 - 5. Face Symmetry: Running Match / Balanced Match / Center Balanced Match. (TBD)
 - 6. Precondition raw veneer prior to applying top coat.
- C. Adhesives
 - 1. Adhesives: Face to core adhesives shall be Type I. Adhesives must be classified Type I per WDMA TM-6 "Adhesive Bond Test Method."
- D. Core
 - 1. Non-rated and 20 minute doors: Solid particleboard ANSI 208.1-LD-2, SCL, or Agri-Fiber ANSI 208.1-LD-1.
 - 2. Fire-rated doors: Non-combustible mineral core containing no asbestos.

2.03 FACTORY FINISHING

- A. Comply with referenced WDMA Section G-15, "Factory Finishing.".
- B. Pre-finish wood doors at factory.
- C. Transparent Finish: Match finish indicated in WDMA Section G-17: WDMA System #6.

2.04 ACCESSORIES

- A. Metal Louvers:
 - 1. General: Provide Minimum 18-gauge louver frame with minimum 22-gauge louver blades. Louver blades to be sight proof inverted Y type. Provide galvanized insect screen at exterior locations. At exterior and wet areas provide A60 or G60 louvers.
 - 2. Non-rated doors: Provide Anemostat, Air Louvers, All Metal Stamping
 - 3. Fire-rated Doors: Provide fusible link louver by Anemostat, All Metal Stamping, Air Louvers.

- 4. Fasteners: Provide manufacturers standard mechanical fasteners. Exposed fasteners to be on secure side of door.
- B. Wood Vision Frames:
 - 1. General: Wood, of the same species/compatible with door species
 - 2. Non-Rated: W9 Flush/W7 Lip beading wood of the same species/compatible with door species.
 - 3. Fire-Rated
- C. Metal Vision Frames:
 - 1. General: Provide minimum 20-gauge vision frames that protrude no more than 5/64" over face of frame. At exterior and wet areas provide A60 or G60 vision frames.
 - 2. Non-rated doors: Provide Anemostat, Air Louvers, All Metal Stamping metal vision frame.
 - 3. Labeled Doors: Provide Anemostat, Air Louvers, All Metal Stamping metal vision frame with glazing tape.
 - 4. Fire-rated doors: ITS Warnock Hersey or UL approved glazing system.
 - 5. Glass: Refer to Section 08810 for glass types and thickness.
 - 6. Fasteners: Provide manufacturers standard mechanical fasteners. Exposed fasteners to be on secure side of door.

2.05 FABRICATION

- A. Fabricate wood doors in accordance with requirements of WDMA I.S. 1-A 2011 Quality Standards.
- B. Fabricate fire rated doors in accordance with requirements of ITS Warnock Hersey, Underwriters' Laboratories, or California State fire Marshall with metal label on each door including UL-10C.
- C. Provide blocking for hardware per hardware manufacturers requirements for hardware to be installed without thru-bolts on all mineral core doors where locks, closers, panics and or kick plates are installed.
- D. Fabricate doors with WDMA Quality Standards hardware blocking options as follows:
 - 1. Provide HB-1 head and HB-2 sill rails and HB-4 lock block on all doors.
 - 2. Provide HB-6 only when exit devices are specified for door.
 - 3. Provide HB-8 for pivots or when floor bolts are specified under Section 08710 Finish Hardware.
- E. Non-rated and 20-minute rated shall have vertical edges that shall be veneer banded stiles (or) optional 2-ply solid wood 7/16 prior to bevel
- F. Make cutouts and provide stops for glass and louvers. Install metal door louvers. Seal cutouts prior to installation of moldings.
 - 1. For full light doors: Provide cut out from flush wood door, with vertical grain direction.
- G. Bevel lock and hinge edges of single acting doors 3 degrees or 1/8 inch in 2 inches. Radius strike edge of double acting swing doors as required by pivot hinge manufacturer.
- H. Prepare doors to receive hardware. Refer to Section 08710 Hardware and NFPA 80 for hardware requirements including UL-10C.
 - 1. Prefit and bevel to net opening size less approximately 1/4 inch in width on single swing doors 3/16" inch in width for paired doors. Provide clearance based on NFPA-

80 allowable clearances above finished floor, unless otherwise indicated on drawings. Provide 1/8 inch clearance at top of door.

- 2. Slightly ease vertical edges. 3. Predrill pilot holes for all butt hinge mortise preps.
- Fire Rated Pair of Doors; greater than 20 minute: Supply overlapping astragals or metal edge sets only as required by NFPA 80 1999 or by door manufacturer's fire door authorities. If an astragal is required, to comply with fire rated labeling requirements for pairs of fire rated doors, provide door manufacturer's standard tested astragal as required. No Metal Edges or astragal required for 20minute rated pairs.

2.06 SOURCE QUALITY CONTROL

A. Inspect doors prior to shipment, any doors that are damaged, not machined properly or defective shall be repaired to manufacturer's quality standards for new doors or be replaced prior to shipment.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine installed door frames before hanging doors and notify the general contractor of any or all discrepancies.
- B. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Inspect jobsite to ensure a dry and secure area that meets manufacturer's storage recommendations is available and ready to receive the doors prior to delivery of doors.

3.02 PREPARATION

Prior to delivery of wood doors, and while wood doors are being stored, the storage area shall:

- A. Be free of all trash and debris.
- B. Meet manufacturer's recommendations for storage of wood doors.
- C. Be conditioned and have stabilized humidity control.

3.03 INSTALLATION

- A. Handle doors in accordance with recommendations of WDMA I.S. 1-A, "Care and Installation at Job Site."
- B. Condition doors to average temperature and humidity in area of installation for not less than 48 hours prior to installation. Store doors per recommendations of WDMA I.S. 1-A, "Care and Installation at Job Site."
- C. Install in neat and workmanlike manner, free from hammer or tool marks, open joints or slivers.
- D. Set plumb, level, square and true. Install doors after building humidity is at acceptable level.
- E. Remove and replace all warped, twisted, bowed, or otherwise damaged doors. Do not install doors that cannot be properly fitted to frames.
- F.Adjust prefinished doors and hardware and other moving or operating parts to function smoothly and correctly.
- G. If doors are to be field finished, the process must follow the WDMA I.S. 1-A, "Care and Handling at Job Site" instructions for field applied finishes.
- H. Ensure that smoke gaskets are in-place before prefinished door installation.

- I. Ensure that all seals and gaskets are in-place before STC door installation.
- J. Protect the work of other trades damage from the installation of doors and frames.
- K. Install doors in accordance with the following:
 - 1. Manufacturer's instructions, recommendations and tolerances.
 - 2. NFPA-80
 - 3. SDI-105
 - 4. Approved Finish Hardware Schedule
 - 5. Approved Door and Frame Schedule
 - 6. Approved Shop Drawings
 - 7. All applicable codes and requirements

3.04 FIELD QUALITY CONTROL

- A. Lead lined openings are to be field tested by a certified independent testing agency. Any problems are to be corrected prior to the field inspection.
- B. Test all openings with electrified hardware after installation to ensure proper operation.
- C. Manufacturer's representative to inspect the jobsite upon substantial completion and provide a written report on any problems on the project. Provide 1 copy of this report to the material supplier, general contractor, architect, installer and the owner.
- D. All discrepancies listed in the report are to be corrected prior to final acceptance.

3.05 ADJUSTING AND CLEANING

Prior to final acceptance and at no additional cost to owner:

- A. Adjust doors to meet required tolerances.
- B. General Contractor to clean doors per manufacturer's instructions to be free from all foreign materials.
- C. Repair damaged doors per manufacturer's instructions and guidelines.
- D. Replace damaged doors that cannot be repaired to the manufacturer's standards of quality.
- E. Replace defective doors.

3.06 DEMONSTRATION

Demonstrate and explain the operation of automatic doors to the building maintenance director and chief engineer prior to final acceptance.

3.07 PROTECTION

- A. Keep poly bags on doors until date of acceptance.
- B. Protect doors from damage by other trades.
- C. Keep area around doors free from trash and debris.
- D. At unfinished and clear finished doors, do not partially cover door surfaces with paper, cardboard, or any other opaque covering that will create uneven aging of wood veneer.
- E. Protect doors as directed under Section 01 66 00.

END OF SECTION

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SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Provide all labor and material required to furnish and install overhead coiling service doors as indicated in the drawings and specified herein.
- B. Related Sections
 - 1. Section 05 50 00 Metal Fabrications: Metal supports and headers.
 - 2. Section 09 90 00 Painting: Field applied finish.
 - 3. Division 26 Basic Electrical Materials and Methods: Service and connection to operator. Empty raceway for remote control and safety equipment.

1.03 STANDARDS AND REFERENCES

- A. ASTM A 1018 Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot- Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability.
- B. ASTM B 241 Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
- C. ASTM B 597 Standard Practice for Heat Treatment of Aluminum Alloys.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Installer Qualifications:
 - 1. Acceptable to or licensed by manufacturer
- C. Regulatory Requirements: UL listed motor, controls and equipment.
- D. Mock-Up: Provide a mock-up for evaluation of fabrication and application workmanship.
 - 1. Preview display available at Porvene.
 - 2. Do not proceed with remaining work until workmanship is approved by Architect.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 - Shop

Drawings and Samples.

- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Product Data: Manufacturer's specifications and technical data including the following.
 - 1. Detailed specification of construction and fabrication, gauge and type of metal; parts list; name, address, and phone number of installing distributor; and operating and maintenance instructions.
 - 2. Include electrical characteristics of components and voltage requirements provided by other, but required to operate assembly.
 - 3. Installation methods including size and location of mounting bolts.
 - 4. Brochure.
- D. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, anchorage methods, hardware, including specific requirements indicated.
 - 5. Indicate location of motor operator.
 - 6. Height and width dimensions, and jamb conditions.
 - 7. Opening sizes.
 - 8. Details of slats.
 - 9. Track, jambs, and hardware.
- E. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns, if requested.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Store products in manufacturer's unopened packaging until ready for installation.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

Not required.

1.11 RECORD DRAWINGS

Provide in accordance with Section 01 77 00 Project Closeout.

1.12 WARRANTY

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Contractor has responsibility for an extended Corrective Period for work of this Section for the period stated from date of Substantial Completion against all the conditions indicated below, and when notified in writing from Owner.
 - 1. 24 months (Series 400, 500, 600).
- D. Contractor shall promptly and without inconvenience and cost to Owner correct said deficiencies through installing dealer.
 - 1. Failure due to defective materials and workmanship.
 - 2. Failure due to design or installation performance to resist wind loading.
- E. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor.

PART 2 – PRODUCTS

2.01 <u>MANUFACTURERS</u>

- A. Basis of Design: Porvene Doors, Inc.; 14241 Grant St., Moreno Valley, CA 92553. ASD. Tel: (877) 906-3999. Fax: (877) 343-6677. Email: porvene@porvenedoors.com. Web: www.porvenedoors.com.
- B. Or Architect approved equal.

2.02 SERVICE COILING DOORS

- A. Series 400 as manufactured by Porvene Doors, Inc
 - 1. Mounting: Interior face mounted on a prepared opening.
 - Wind load: Door construction designed to satisfy wind load of 20 psf (0.96 kpa) or 87 mph (140 kph). Consult factory for available sizes and corresponding wind loads.
 - Flat Slat: Slats shall be flat shaped cold roll-formed in continuous lengths of 2-1/8 inches (54 mm) by 3/4 inch (19 mm) galvanized steel. Galvanized according to A.S.T.M. A653-G60 and finished with baked epoxy primer and baked polyester topcoat.
 - 4. Slat construction: 24 gauge galvanized steel cold roll-formed in continuous lengths.
 - 5. Operation:
 - a. Electric motor: Porvene motor 1/2 H.P. 115 volt single phase power.
- B. Materials:
 - 1. Steel Sheet: ASTM A653
- C. Fabrication:

- 1. Endlocks: Each end of alternate slats shall be fitted with endlocks to provide a wearing surface in the guides and to maintain slat alignment. Fastened with 1/4 inch rivets.
 - a. Stamped End-locks: Stamped end-locks shall be fitted onto every other slat.
- Bottom Bar: Curtain shall be reinforced with a bottom bar consisting of two 2 inch by 2 inch by 1/8 inch (50.8 mm by 50.8mm by 3.21 mm) structural steel angle with P.V.C. bulb astragal.
- 3. Barrel shall be a steel pipe of diameter and wall thickness to restrict maximum deflection to 0.03 inch per foot (2.5mm/m) of door width. End bearings shall be self-lubricating ball bearings or oil impregnated bronze bushings.
- 4. Springs shall be oil tempered, grease packed helical torsion type designed with an overload factor of 25 percent. Springs mounted on a cold rolled steel inner shaft
 - a. 20,000 Cycle Springs: spring design is to last at least 20,000 cycles.
- 5. Bracket Plates: 1/4 inch (6 mm) minimum thickness steel plates to sustain and enclose ends of door assembly.
- 6. Drive end bracket plate: Fitted with a self-aligning sealed ball bearing.
- 7. Guides shall be structural steel angles 3/16 inch (4.76 mm) minimum thickness with removable head stops.
- 8. Guide wall angles: 3/16 inch (4.76 mm) minimum thickness structural steel angles.
- 9. Hoods shall be 24 gauge galvanized steel with baked epoxy primer and baked polyester top coat.
- D. Finish:
 - 1. Standard Baked-On Finish: Baked epoxy primer and baked polyester topcoat.
 - 2. Ungalvanized Surfaces: Shop coated with rust reducing black prime paint.
- E. Operation:
 - 1. Electric operator: Electric motor with emergency manual release and with manual machine link hand chain depending on model.

PART 3 – EXECUTION

- 3.01 EXAMINATION
 - A. Do not begin installation until openings have been properly prepared. Verify electrical service size and wiring is complete.
 - B. Verify clearance for operator and jamb width prior to fabrication of doors.
 - C. Verify empty race way for controls and safety equipment is completed.
 - D. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install doors plumb, true, and square in a rigid manner.
- C. Install related conduits and electrical/control wiring for complete installation for power

source indicated.

- 1. Adjust hardware and automatic closing equipment.
- 2. Verify and coordinate terminal requirements with electrical.

END OF SECTION

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SECTION 08 71 00

DOOR AND WINDOW HARDWARE

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. This section includes the following:
 - 1. Furnish door hardware (for hollow metal, wood and aluminum doors) specified herein, listed in the hardware schedule, and/or required by the drawings.
 - 2. Hardware for Aluminum Doors
 - 3. Thresholds and Weather-stripping (Aluminum frame seals to be provided by aluminum door supplier)
 - 4. Electro-Mechanical Devices
 - 5. Access Control components and or systems specified within this section.
- B. Where items of hardware are not definitely or correctly specified and is required for the intended service, such omission, error or other discrepancy should be directed to the Architect prior to the bid date for clarification by addendum. Otherwise furnish such items in the type and quantity established by this specification for the appropriate service intended.
- C. This section includes all material, and related service necessary to furnish all finish hardware indicated on the drawings, or specified herein.
- D. Furnish UL listed hardware for all labeled and 20 min. openings in conformance with the requirements for the class of opening scheduled. Underwriters' requirements shall have precedence over specification where conflicts exist
- E. This section includes coordination with related work in the following sections:
 - 1. Division 6 Section "Finish Carpentry".
 - 2. Division 6 Section "Architectural Casework"
 - 3. Division 8 Section "Metal Doors and Frames".
 - 4. Division 8 Section "Wood Doors"
 - 5. Division 8 Section "Aluminum Doors, Door Frames and Window Frames"
 - 6. Division 26 Sections "Electrical".

1.03 STANDARDS AND REFERENCES

- A. All work shall be in accordance with all applicable state and local building codes. Code requirements shall have precedence over this specification where conflicts exist.
- B. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.
 - 1. DHI Recommended Locations for Builders' Hardware.
 - 2. NFPA 80 Standards for Fire Doors and Windows.

- 3. NFPA 101 Code for Safety to Life from Fire in Buildings and Structures.
- 4. UL Building Material Directory.
- 5. DHI Door and Hardware Institute
- 6. WHI Warnock Hersey
- 7. BHMA Builders Hardware Manufacturers Association
- 8. ANSI American National Standards Institute
- 9. IBC International Building Code Edition as adopted and amended by local building code authorities

1.04 QUALITY ASSURANCE

- A. Where indicated in this specification, products shall be independently certified by ANSI for compliance with relevant ANSI/BHMA standards A156.1 - A156.36 – Standards for Hardware and Specialties. All products shall meet or exceed certification requirements for the respective grade indicated within this specification. Supplier shall provide evidence of certification when requested by the architect.
- B. Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- C. Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. When electronic hardware components other than those indicated in hardware sets are provided, the supplier shall be responsible for all costs incurred by the design team and their consultants to review, and revise electrical drawings and electrical specifications. Supplier shall also be responsible for any additional costs associated with required changes in related equipment, materials, installation, or final hook up to insure the system will operate and function as indicated in the construction documents, including hardware set operational / functional descriptions.
- D. All hardware items shall be manufactured no earlier than 6 months prior to delivery to site.
- E. Hardware supplier shall be factory trained and certified by the manufacture to provide and support all computer managed locks and system components.
- F. Installation of hardware shall be installed or directly supervised and inspected by a skilled installer certified by the manufacturer of locksets, door closers, and exit devices used on the project, or with not less than 3 years' experience in successful completion of projects similar in size and scope.
- G. Provide hardware for all labeled fire doors, which complies with positive pressure fire testing UL 10C.
- H. Comply with all applicable provisions of the standards referenced within section 1.4 of this specification.
- Hardware supplier shall participate when reasonably requested to meet with the contractor and or architect to inspect any claim for incorrect or non-functioning materials; following such inspection, the hardware supplier shall provide a written statement documenting the cause and proposed remedy of any unresolved items.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Within ten days after award of contract, submit detailed hardware schedule in quantities as required by Division 1 General Conditions.
- D. Schedule format shall be consistent with recommendations for a vertical format as set forth in the Door & Hardware Institute's (DHI) publication "Sequence and Format for the Hardware Schedule". Hardware sets shall be consolidated to group multiple door openings which share similar hardware requirements. Schedule shall include the following information:
 - 1. Door number, location, size, handing, and rating.
 - 2. Door and frame material, handing.
 - 3. Degree of swing.
 - 4. Manufacturer
 - 5. Product name and catalog number
 - 6. Function, type and style
 - 7. Size and finish of each item
 - 8. Mounting heights
 - 9. Explanation of abbreviations, symbols, etc.
 - 10. Numerical door index, indicating the hardware set/ group number for each door.
- E. When universal type door closers are to be provided, the schedule shall indicate the application method to be used for installation at each door: (regular arm, parallel arm, or top jamb).
- F. The schedule will be prepared under the direct supervision of a certified Architectural Hardware Consultant (AHC) employed by the hardware distributor. The hardware schedule shall be signed and embossed with the DHI certification seal of the supervising AHC. The supervising AHC shall attend any meetings related to the project when requested by the architect.
- G. Check the specified hardware for suitability and adaptability to the details and surrounding conditions.
- H. Review drawings from related trades as required to verify compatibility with specified hardware. Indicate unsuitable or in compatible items, and proposed substitutions in the hardware schedule.
- I. Provide documentation for all hardware to be furnished on labeled fire doors indicating compliance with positive pressure fire testing UL 10C.
- J. Furnish manufacturers' catalog data for each item of hardware in quantities as required by Division 1 General Conditions.
- K. Submit a sample of each type of hardware requested by the architect. Samples shall be of the same finish, style, and function as specified herein. Tag each sample with its permanent location so that it may be used in the final work.
- L. Furnish with first submittal, a list of required lead times for all hardware items.
- M. After final approved schedule is returned, transmit corrected copies for distribution and field use in quantities as required by Division 1 General Conditions.

- N. Furnish approved hardware schedules, template lists, and pertinent templates as requested by related trades.
- O. Furnish necessary diagrams, schematics, voltage and amperage requirements for all electromechanical devices or systems as required by related trades. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.
- P. After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner's representative to determine keying requirements. Upon completion of the initial key meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute's publication "Keying Procedures, Systems, and Nomenclature". Submit copies of owner approved key schedule for review and field use in quantities as required by Division 1 General Conditions. Wiring diagrams shall be included in final submittals transmitted for distribution and field use.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Hardware supplier shall deliver hardware to the job site unless otherwise specified.
- D. All hardware shall be delivered in manufacturers' original cartons and shall be clearly marked with set and door number.
- E. Coordinate with contractor prior to hardware delivery and recommend secure storage and protection against loss and damage at job site.
- F. Contractor shall receive all hardware and provide secure and proper protection of all hardware items to avoid delays caused by lost or damaged hardware. Contractor shall report shortages to the Architect and hardware supplier immediately after receipt of material at the job site.
- G. Coordinate with related trades under the direction of the contractor for delivery of hardware items necessary for factory installation.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.011 PRE-INSTALLATION MEETING

- A. Schedule a hardware pre-installation meeting on site to review and discuss the installation of continuous hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.
- B. Meeting attendees shall be notified 7 days in advance and shall include: Architect, Contractor, Door Hardware Installers (including low voltage hardware), Manufacturers representatives for above hardware items, and any other effected subcontractors or suppliers.
- C. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

1.012 WARRANTY

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.19.C Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Repair, replace, or otherwise correct deficient materials and workmanship without additional cost to owner.

PART 2 - PRODUCTS

2.01 FASTENERS

- A. All exposed fasteners shall be Phillips head or as otherwise specified, and shall match the finish of the adjacent hardware. All fasteners ex-posed to the weather shall be non-ferrous or stainless steel. Furnish correct fasteners to accommodate surrounding conditions.
- B. Coordinate required reinforcements for doors and frames. Seek approval of the architect prior to furnishing through-bolts. Furnish through-bolts as required for materials not readily reinforced.

2.02 BUTT HINGES

A. Acceptable manufacturers and respective catalog numbers:

		lves
1.	Standard Weight, Ball Bearing	5BB1
2.	Standard Weight, Ball Bearing, Non-Ferrous	5BB1
3.	Heavy Weight, Ball Bearing	5BB1HW
4.	Heavy Weight, Ball Bearing, Non-Ferrous	5BB1HW

- B. Hinges shall be independently certified by ANSI for compliance with ANSI A156.1 (2006). Hinges shall meet or exceed the following ANSI grade requirements as indicated below:
 - 1. Standard Weight, Plain Bearing Hinges: Grade 3
 - 2. Standard Weight, 2 Ball Bearing Hinges: Grade 2
 - 3. Heavy Weight, 4 Ball Bearing Hinges: Grade 1
- C. Unless otherwise specified, furnish the following hinge quantities for each door leaf.
 - 1. 3 hinges for doors up to 90 inches.

- 2. 1 additional hinge for every 30 inch on doors over 90 inches.
- 3. 4 hinges for Dutch door applications.
- D. Unless otherwise specified, top and bottom hinges shall be located as specified in division 8 Section "Hollow Metal Doors and Frames". Intermediate hinges shall be located equidistant from others.
- E. Unless otherwise specified, furnish hinge weight and type as follows:
 - 1. Standard weight: plain bearing hinge 5PB1 for interior openings through 36 inches wide without a door closer.
 - 2. Standard weight: ball bearing hinge 5BB1 for interior opening over 36 through 40 inches wide without a door closer, and for interior openings through 40 inches wide with a door closer.
 - 3. Heavyweight: 4 ball bearing hinge 5BB1HW for interior openings over 40 inches wide, and for all vestibule doors.
 - 4. Heavyweight: 4 ball bearing hinge 5BB1HWss for exterior openings unless otherwise listed in groups.
- F. Unless otherwise specified, furnish hinges for exterior doors, fabricated from brass, bronze, or stainless steel. Unless otherwise specified, hinges for interior doors may be fabricated from steel.
- G. Unless otherwise specified, furnish hinges in the following sizes:
- 1. 5" x 5" 2-1/4" thick doors
- 2. 4-1/2" x 4-1/2" 1-3/4" thick doors
- 3. 3-1/2" x 3-1/2" 1-3/8" thick doors
- H. Furnish hinges with sufficient width to accommodate trim and allow for 180-degree swing.
- I. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins at interior doors, non-removable loose pins (NRP) at exterior and out-swinging interior doors.
- J. Unless otherwise specified, furnish all hinges to template standards.

2.03 POWER TRANSFERS

A. Acceptable manufacturers and respective catalog numbers:

Von Duprin

- 1. Concealed Two Wire EPT-10
- B. Door cords shall be armored cable with screw on caps.
- C. Concealed power transfers shall be concealed in the door and frame when the door is closed.
- D. Concealed power transfers shall have a steel tube to protect wires from being cut.
- E. Concealed power transfers with spring tubes shall be rejected.
- F. Concealed power transfers shall be supplied with a mud box to house all terminations.

2.04 EXIT DEVICES

A. Acceptable manufacturers and respective catalog numbers:

	<u>Von Duprir</u>
Wide Stile, Push Pad	87/99
Lever Trim	06 Series

- B. Exit devices shall be independently certified by ANSI for compliance with ANSI A156.3, Grade 1 (2008).
- C. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. All exit devices shall be equipped with a sound-dampening feature to reduce touch pad return noise.
- E. On full glass doors there shall be no exposed fasteners on the back of the mechanism visible through the glass.
- F. All exit devices shall be provided with flush end caps to reduce potential damage from impact.
- G. All exit devices shall be provided with dead-locking latch bolts to insure security.
- H. All exit devices shall be U.L. listed for accident hazard. Exit device for use on fire doors shall also be U.L. listed for fire exit hardware.
- I. Provide optional strikes, special length rods, and adapter plates to accommodate door and frame conditions. Provide narrow style series devices in lieu of wide stile series devices where optional strikes will not accommodate door and frame conditions.
- J. Coordinate with related trades to insure adequate clearance and reinforcement is provided in doors and frames. Provide thru bolts as required.
- K. Refer to hardware groups for exit device applications utilizing the option of: "less bottom rod and floor strike" (LBR)
- L. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.
- M. Unless specific exit device dogging options are noted within hardware sets, provide dogging options as follows:
- N. Fire Rated devices: Dogging not permitted.
- O. Non-Rated Exit Only functions not equipped with outside trim or pull: Less Dogging.
- P. Non-Rated Classroom functions: Less Dogging.
- Q. Non-Rated devices utilizing electric latch retraction or electrified outside trim: Less Dogging.
- R. All Other Non-Rated devices: Cylinder Dogging utilizing interchangeable core cylinders. Cylinder keyway shall match locksets furnished on this project.
- S. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.
- T. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.
- U. Provide reinforced crossbars for all traditional style exit devices applied to doors over 36" wide.

2.05 LOCKS AND LATCHES

A. Acceptable manufacturers and respective catalog numbers:

<u>Schlage</u>

Grade 1 Cylindrical ND Series RHO

B. Bored locks shall be independently certified by ANSI for compliance with ANSI A156.2 (2011). Interconnected locks shall be independently certified by ANSI for compliance with ANSI A156.12 (2013). Mortise locks shall be independently certified by ANSI for compliance with ANSI A156.13 (2012).

- C. Unless otherwise specified, all locks and latches to have:
 - 1. 2-3/4" Backset
 - 2. 1/2" minimum throw latchbolt
 - 3. 1" throw deadbolt
 - 4. ANSI A115.2 strikes
- D. Provide guarded latch bolts for all locksets, and latch bolts with sufficient throw to maintain fire rating of both single and paired door assemblies.
- E. Length of strike lip shall be sufficient to clear surrounding trim.
- F. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.

lves

2.06 PULLS, PUSH BARS, PUSH/PULL PLATES

A. Acceptable manufacturers and respective catalog numbers:

Straight Pull (1" dia., 10" ctc)	8103-0
Full Length Pull	9264
Pull / Push-Bar (1" dia., 10" ctc Pull)	9100-0
Push Plate (.050 6"X 16")	8200 6"X 16"

Adjust dimensions of push plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, push plates shall be factory drilled for cylinders or other mortised hardware. All push plates shall be beveled 4 sides and counter sunk.

B. Where possible, provide back-to-back, and concealed mounting for pulls and push bars. Push bar length shall be 3" less door width, or center of stile to center of stile for stile & rail or full glass doors.

2.07 CLOSERS

A. Acceptable manufacturers and respective catalog numbers:

LCN

1. 4040 XP

- B. Door closers shall be independently certified by ANSI for compliance with ANSI A156.4, Grade 1 (2013).
- C. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. Provide extra heavy duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.
- E. Hardware supplier shall coordinate with related trades to insure aluminum frame profiles will accommodate specified door closers.
- F. Provide "SPECIAL TEMPLATE #1728 / #0723" closer arms as required to accommodate aluminum frame head details with "non-structural stops" when closers will be required to utilize parallel arm mounting positions. Frame mounting shoe shall be shortened, and pivot hub height shall be increased to permit frame mounted shoe to be positioned on frame rabbit (rather than the frame stop), and behind the frame stop rather than on top of the frame stop. Contact LCN Door Closers at: 877-671-7011 for pricing and design assistance.

- G. Closers shall use high strength cast iron cylinders, and 1 piece forged steel pistons.
- H. Closers shall utilize a stable fluid withstanding temperature range of +120deg F to -30deg F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.
- I. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.
- J. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.
- K. Provide closers with adjustable spring power. Size closers to insure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.
- L. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.
- M. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.
- N. Pressure Relief Valve, PRV, shall not be acceptable.

2.08 KICK PLATES AND MOP PLATES

- A. Furnish protective plates as specified in hardware groups.
- B. Where specified, provide 10" kick plates, 34" armor plates, and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick; plastic plates shall be 1/8" thick.
- C. Protective plates shall be 2" less door width, or 1" less door width at pairs. All protective plates shall be beveled 4 sides and counter sunk. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing.
- D. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.
- E. Adjust dimensions of protection plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.

2.09 WALL STOPS AND HOLDERS

A. Acceptable manufacturers and respective catalog numbers:

	lves
1. Wrought Concave Wall Bumper	WS406CCV
2. Automatic Wall Holder	WS40
3. Floor Stop	FS410
4. Wall Stop (Stick Stop)	WS65

- B. Furnish a stop or holder for all doors. Furnish floor stops only where specifically specified.
- C. Where wall stops are not applicable, furnish overhead stops.
- D. Do not provide holder function for labeled doors.

2.010 WEATHERSTRIP, GASKETING

A. Acceptable manufacturers and respective catalog numbers:

	<u>Zero</u>
Weatherstrip	429
Adhesive Gasket	188
Sweep w/ drip	8198
Drip Cap	142

- B. Weatherstrip and gasketing shall be independently certified by ANSI for compliance with ANSI A156.22 (2005).
- C. Where specified in the hardware groups, furnish the above products unless otherwise detailed in groups.
- D. Provide weatherstripping all exterior doors and where specified.
- E. Provide intumescent and other required edge sealing systems as required by individual fire door listings to comply with positive pressure standards UL 10C.
- F. Provide Zero 188 smoke gaskets at all fire rated doors and smoke and draft control assemblies.
- G. Provide gasketing for all meeting edges on pairs of fire doors. Gasketing shall be compatible with astragal design provided by door supplier as required for specific fire door listings.

2.011 THRESHOLDS

A. Acceptable manufacturers and respective catalog numbers:

655

<u>Zero</u>

Saddle Thresholds

Thresholds shall be independently certified by ANSI for compliance with ANSI A156.21 (2001).

- B. Hardware supplier shall verify all finish floor conditions and coordinate proper threshold as required to insure a smooth transition between threshold and interior floor finish.
- C. Threshold Types:
 - 1. Unless otherwise specified, provide saddle threshold similar to Zero 8655 for all exterior openings with an interior floor finish less than or equal to 1/4" in height.
 - 2. Unless otherwise specified, provide half saddle threshold similar to Zero 1674 for all exterior openings with an interior floor finish greater than 1/4" in height. Threshold height shall match thickness of interior floor finish.

2.012 ELECTRIC STRIKES

A. Acceptable manufacturers and respective catalog numbers:

Von Duprin Folger Adams

Type 1 6000 Series 300 Series

- B. Provide electric strikes designed for use with the type of locks shown at each opening where specified.
- C. Electric strikes shall be UL listed as Burglary-Resistant Electric Door Strikes and where required shall be UL listed as Electric Strike for Fire Doors.
- D. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.013 POWER SUPPLIES

- A. Provide quantities and types as specified in hardware sets. Shared power supplies will not be accepted without prior approval from the owner.
- B. All power supplies shall have the following features:
 - 1. 12/24 VDC Output, field selectable.
 - 2. Class 2 Rated power limited output.
 - 3. Universal 120-240 VAC input.
 - 4. Low voltage DC, regulated and filtered.
 - 5. Polarized connector for distribution boards.
 - 6. Fused primary input.
 - 7. AC input and DC output monitoring circuit w/LED indicators.
 - 8. Cover mounted AC Input indication.
 - 9. Tested and certified to meet UL294.
 - 10. NEMA 1 enclosure.
 - 11. Hinged cover w/lock down screws.
 - 12. High voltage protective cover.
- C. All power supplies shall incorporate fused distribution boards.
- D. All electro-mechanical systems requiring fail safe circuits shall be capable of interfacing with the fire alarm system to cut power to appropriate system components. Unless already provided in another system component, all power supplies utilized in fail safe circuits shall include an integral relay which when connected to the N/C fire alarm contact will cut power to all openings connected to the individual power supply. Power supply, unless otherwise specified, will automatically reset itself when fire alarm relay returns to normal state following a fire alarm.

2.014 FINISHES AND BASE MATERIALS

A. Unless otherwise indicated in the hardware groups or herein, hardware finishes shall be applied over base metals as specified in the following finish schedule:

HARDWARE ITEM	BHMA FINISH AND BASE MATERIAL
Butt Hinges: Exterior, or Non- Ferrous	630 (US32D - Satin Stainless Steel)
Butt Hinges: Interior	652 (US26D - Satin Chromium)
Continuous Hinges	630 (US32D - Satin Stainless Steel)
Exit Devices	626 (US26D - Satin Chromium)
Locks and Latches	626 (US26D - Satin Chromium)
Pulls and Push Plates/Bars	630 (US32D - Satin Stainless Steel)
Closers	689 (Spray Coat Aluminum)
Protective Plates	630 (US32D - Satin Stainless Steel)
Wall Stops and Holders	630 (US32D - Satin Stainless Steel)
Thresholds	628 (Mill Aluminum)

Weather-strip, Sweeps Drip Caps (wood and hollow metal doors)	Aluminum Anodized
Weather-strip, Sweeps Drip Caps (aluminum doors)	Match finish of aluminum doors.
Miscellaneous	626 (US26D - Satin Chromium)

2.015 KEYING

A. Acceptable manufacturers and respective catalog numbers:

<u>Schlage</u>

Best Loc 1C72

- B. Provide all locks and cylinders utilizing a patented keyway to prevent manufacturing and distribution of aftermarket key blanks by anyone other than factory authorized dealers.
- C. All locks under this section shall be keyed as directed by the owner to a new Restricted Patented Grand Master Key System.
- D. Keying shall be by lock manufacturer where permanent records shall be kept.
- E. Furnish a total of 2 keys per cylinder. Actual cut keys to be determined by owner.
- F. Master keys and control keys to be delivered by registered mail to the owner. Change keys shall be delivered in a set up key cabinet. Construction keys shall be delivered to the contractor.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, installer shall examine door frame installation to insure frames have been set square and plumb. Installer shall examine doors, door frames, and adjacent wall, floor, and ceiling for conditions, which would adversely affect proper operation and function of door assemblies. Do not proceed with hardware installation until such deficiencies have been corrected.

3.02 INSTALLATION

- A. Before hardware installation, general contractor/construction manager shall coordinate a hardware installation seminar with a 1 week notice to all parties involved. The seminar is to be conducted on the installation of hardware, specifically of locksets, closers, exit devices, continuous hinges and overhead stops. Manufacturer's representative of the above products to resent seminar. Seminar to be held at the job site and attended by installers of hardware (including low voltage hardware) for aluminum, hollow metal and wood doors. Training to include use of installation manuals, hardware schedule, templates and physical products samples.
- B. Install all hardware in accordance with the approved hardware schedule and manufacturer's instructions for installation and adjustment.
- C. Set units level, plumb and true to the line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accord with industry standards.
- E. Drill appropriate size pilot holes for all hardware attached to wood doors and frames.
- F. Shim doors as required to maintain proper operating clearance between door and frame.

- G. Unless otherwise specified, locate all hardware in accordance with the recommended locations for builders hardware for standard doors and frames as published by the Door and Hardware Institute.
- H. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.
- I. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.
- J. Conceal push and pull bar fasteners where possible. Do not install through bolts through push plates.
- K. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the label.
- L. Apply self-adhesive gasketing on frame stop at head & latch side and on rabbet of frame at hinge side.
- M. Install hardware in accordance with supplemental "S" label instructions on all fire rated openings.
- N. Install wall stops to contact lever handles or pulls. Do not mount wall stops on casework, or equipment.
- O. Where necessary, adjust doors and hardware as required to eliminate binding between strike and latchbolt. Doors should not rattle.
- P. Overhead stops used in conjunction with electrified hold open closers shall be templated and installed to coincide with engagement of closer hold open position.
- Q. Install door closers on corridor side of lobby doors, room side of corridor doors, and stair side of stairways.
- R. Adjust spring power of door closers to the minimum force required to insure exterior and fire rated doors will consistently close and latch doors under existing conditions. Adjust all other door closers to insure opening force does not to exceed 5 lbs.
- S. Adjust "sweep", "latch", & "back check" valves on all door closers to properly control door throughout the opening and closing cycle. Adjust total closing speed as required to comply with all applicable state and local building codes.
- T. Install "hardware compatible" (bar stock) type weatherstripping continuously for an uninterrupted seal. Adjust templating for parallel arm door closers, exit devices, etc., as required to accommodate weatherstripping.
- U. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Set thresholds in full bed of sealant.
- V. Compress sweep during installation as recommended by sweep manufacturer to facilitate a water resistant seal.
- W. Deliver to the owner 1 complete set of installation and adjustment instructions, and tools as furnished with the hardware.

3.03 FIELD QUALITY CONTROL

- A. After installation has been completed, the hardware supplier and manufacturer's representative for locksets, door closers, exit devices, and overhead stops shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper application according to the approved hardware schedule. Hardware supplier shall submit a list of all hardware that has not been installed correctly.
- B. After installation has been completed, the hardware supplier and manufacturer's representative shall meet with the owner to explain the functions, uses, adjustment, and

maintenance of each item of hardware. Hardware supplier shall provide the owner with a copy of all wiring diagrams. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.

3.04 ADJUSTMENT AND CLEANING

- A. At final completion, and when H.V.A.C. equipment is in operation, installer shall make final adjustments to and verify proper operation of all door closers and other items of hardware. . Lubricate moving parts with type lubrication recommended by the manufacturer.
- B. All hardware shall be left clean and in good operation. Hardware found to be disfigured, defective, or inoperative shall be repaired or replaced.

3.05 HARDWARE SCHEDULE

A. The following schedule of hardware groups are intended to describe opening function. The hardware supplier is cautioned to refer to the preamble of this specification for a complete description of all materials and services to be furnished under this section.

HARDWARE GROUP NO. 001

For use on Door #(s): E100 Provide each SGL door(s) with the following: 3 ΕA HINGE 630 IVE 5BB1HW 4.5 X 4.5 NRP 1C72 ΕA CORE 626 BES 1 STOREROOM LOCK 1 EA ND80BDC RHO 626 SCH 1 EA LOCK GUARD LG10 630 IVE ΕA SURFACE CLOSER 4040XP SCUSH 689 1 LCN 1 EA KICK PLATE 8400 10" X 2" LDW B-CS 630 IVE 1 EA FLOOR STOP **FS18S** BLK IVE 1 EA GASKETING 429AA-S AA ZER 1 EΑ DOOR SWEEP 39A А ZER 545A-223 1 EA THRESHOLD А ZER

HARDWARE GROUP NO. 002

For us	se on D	oor #(s):				
E108		E117				
Provic	de each	SGL door(s) with the follow	ving:			
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	CORE	1C72		626	BES
1	EA	ELECTRONIC	ISONAS ACCEDK3A	N	BLK	
		ACCESSORY				
1	EA	PANIC HARDWARE	AX-98-NL-OP-110MD		626	VON
1	EA	RIM CYLINDER	1E72 WITH BRASS CONSTRUCTION		626	BES
			CORE			
1	EA	ELECTRIC STRIKE	6300 FSE 12/24VDC	N	630	VON
1	EA	DOOR PULL	VR910 NL		630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS18S		BLK	IVE
1	EA	GASKETING	429AA-S		AA	ZER
1	EA	DOOR SWEEP	39A		А	ZER
1	EA	THRESHOLD	545A-223		А	ZER
1	EA	CREDENTIAL READER	ISONAS RC04PRXWK	×	BLK	

1	EA	DOOR POSITION SWITCH		1076D				SEN
1	EA	POWER SUPPLY		PS902 900-FA 900-2R 120/240 VAC	S 900-BBK	×		VON
1	EA	PROX WIRE HARN	ESS	ISONAS CABLE 25		×	GRY	
HAR	OWARE	GROUP NO. 003						
For u	se on D	oor #(s):		100				
102		104	105	. 120				
Provi	de each	SGL door(s) with the	follov	ving:			050	N/F
3	EA		-	5BB1HW 4.5 X 4.5			652	IVE
1	EA	LOCK	E	ND20BDC RHO			626	SCH
1	EA	CORE		1C72			626	BES
1	EA	FLOOR STOP		FS439			630	IVE
1	EA	GASKETING		188SBK PSA			BK	ZER
HARI	OWARE	<u>GROUP NO. 004</u>						
For u	se on D	oor #(s):						
103		109	114	115	126		127	
128								
Provi	de each	SGL door(s) with the	follov	ving:				
3	EA	HINGE		5BB1HW 4.5 X 4.5			652	IVE
1	EA	PRIVACY LOCK		ND40S RHO			626	SCH
1	EA	WALL STOP		WS406/407CCV			630	IVE
1	ΕA	GASKETING		188SBK PSA			ВК	ZER
HARI	OWARE	GROUP NO. 005						
For u	se on D	oor #(s):						
100		106	110	116	117		118	
125								
Provi	de each	SGL door(s) with the	follov	ving:				
3	EA	HINGE		5BB1HW 4.5 X 4.5			652	IVE
1	EA	CORE		1C72			626	BES
1	EA	STOREROOM LOC	K	ND80BDC RHO			626	SCH
1	EA	SURFACE CLOSE	२	4040XP REG OR PA	AS REQ		689	LCN
1	EA	FLOOR STOP		FS439			630	IVE
1	EA	GASKETING		188SBK PSA			BK	ZER
HARI For u	DWARE	GROUP NO. 006						
101	Se on D	$\cos \pi(3)$.						
Provi	de each	SGL door(s) with the	follov	ving:				
3	EA	HINGE		5BB1HW 4.5 X 4.5 N	RP		652	IVE
1	EA	CORE	_	1C72			626	BES
1	EA	ENTRANCE/OFFIC	E	ND50BDC RHO			626	SCH
1	EA	FLOOR STOP		FS439			630	IVE
1	EA	GASKETING		188SBK PSA			BK	ZER

HARDWARE GROUP NO. 007 For use on Door #(s):

108

Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	CORE	1C72		626	BES
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 24VDC	×	613	VON
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS439		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	ISONAS RC04PRXWK	×	BLK	
1	EA	DOOR POSITION	1076D			SEN
		SWITCH				
1	EA	POWER SUPPLY	PS902 900-FA 900-2RS 900-BBK	×		VON
			120/240 VAC			
1	EA	PROX WIRE HARNESS	ISONAS CABLE 25	×	GRY	

HARDWARE GROUP NO. 008 For use on Door #(s):

119		122 12	23	124		
Prov	ide eacl	n SGL door(s) with the fo	llowing:			
3	EA	HINGE	5BB	1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND4	0S RHO	626	SCH
1	EA	SURFACE CLOSER	4040	XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400) 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS4	06/407CCV	630	IVE
1	EA	GASKETING	1885	SBK PSA	BK	ZER

HARDWARE GROUP NO. 010

For u	ise on D	Door #(s):				
112		113				
Provi	de each	n SGL door(s) with the follow	ving:			
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
1	EA	CORE	1C72		626	BES
1	EA	ELECTRIC STRIKE	6211 FSE 24VDC	N	613	VON
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS439		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	ISONAS RC04PRXWK	×	BLK	
1	EA	DOOR POSITION SWITCH	1076D			SEN
1	EA	PUSH BUTTON, LOCATE AT RECEPTION	623RD 12/24 VDC	×	630	SCE
1	EA	POWER SUPPLY	PS902 900-FA 900-2RS 900-BBK 120/240 VAC	×		VON
1	EA	PROX WIRE HARNESS	ISONAS CABLE 25	N	GRY	

HARDWARE GROUP NO. 011 For use on Door #(s):

129

Provide each PR door(s) with the following:

5	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	N	630	IVE
1	EA	CORE	1C72		626	BES
1	EA	MORTISE CYLINDER	1E74 WITH BRASS CONSTRUCTION CORE		626	BES
1	EA	PANIC HARDWARE	9849-EO		626	VON
1	EA	PANIC HARDWARE	9849-L-E996-06-FS-SNB 24 VDC		626	VON
2	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	FLOOR STOP	FS18S		BLK	IVE
1	EA	ASTRAGAL	8193AA		AA	ZER
1	EA	GASKETING	188SBK PSA		BK	ZER
2	EA	DOOR SWEEP	39A		А	ZER
1	EA	THRESHOLD	545A-223		А	ZER
1	EA	CREDENTIAL READER	ISONAS RC04PRXWK	N	BLK	
2	EA	DOOR POSITION	1076D			SEN
		SWITCH				
1	EA	POWER SUPPLY	PS902 900-FA 900-2RS 900-BBK 120/240 VAC	×		VON
1	EA	PROX WIRE HARNESS	ISONAS CABLE 25	N	GRY	
пург						
Forus		$\frac{1}{100}$ $\frac{1}{100}$ $\frac{1}{100}$ $\frac{1}{100}$ $\frac{1}{100}$ $\frac{1}{100}$				
F112		F113 F129				
Provid	le each	PR door(s) with the followi	nd.			
5		HINGE	5881HW 4 5 X 4 5 NRP		630	IV/E
1			5BB1HW 4.5 X 4.5 TW8	N	630	
1	ΕA	CORE	1072		626	BES
1	ΕΛ		1672 WITH BRASS CONSTRUCTION		626	BES
1			CORE		020	DLO
1	ΕA	ELECTRONIC ACCESSORY	ISONAS ACCEDK3A	×	BLK	
1	EA	PANIC HARDWARE	9849-L-E996-06-FS-SNB 24 VDC		626	VON
1	EA	PANIC HARDWARE	9849-EO		626	VON
2	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	FLOOR STOP	FS18S		BLK	IVE
1	EA	RAIN DRIP CAP	142A		AL	ZER
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	ASTRAGAL	8193AA		AA	ZER
2	EA	DOOR SWEEP	39A		А	ZER
1	EA	THRESHOLD	545A-223		А	ZER
1	EA	CREDENTIAL READER	ISONAS RC04PRXWK	×	BLK	
2	EA	DOOR POSITION SWITCH	1076D			SEN
1	EA	POWER SUPPLY	PS902 900-FA 900-2RS 900-BBK	×		VON
1	EA	PROX WIRE HARNESS	ISONAS CABLE 25	N	GRY	

HARDWARE GROUP NO. RU.01

For u	se on D)oor #(s):			
E129A E129B		E129B E ⁻	129C		
Provi	de eacł	n RU door(s) with the follo	wing:		
1	EA	CORE	1C72	626	BES
1	EA	MORTISE CYLINDER	1E74 WITH BRASS CONSTRUCTION CORE	626	BES

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Material and Labor, as shown on Drawings and as specified herein, including all accessories and hardware for a timely, complete, and proper installation:

- A. High-performance architectural glass.
- B. High-performance insulating glass.

1.03 STANDARDS AND REFERENCES

- A. ANSI Z97.1 American National Standard for Glazing Materials Used in Buildings Safety Performance Specifications and Methods of Test
- B. CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials
- C. Glazing Publications: Comply with published recommendations of glass product manufacturers and industry organizations, including but not limited to those below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. IGMA Publication for Insulating Glass: IGMA TM-3000, Glazing Guidelines for Sealed Insulating Glass Units.
 - 2. GANA Publications: Laminated Glazing Reference Manual; Glazing Manual.
- D. ASTM International:
 - 1. ASTM C162 Standard Terminology of Glass and Glass Products.
 - 2. ASTM C1036 Standard Specification for Flat Glass.
 - 3. ASTM C1048 Standard Specification for Heat-Treated Flat Glass Kind HS, Kind FT Coated and Uncoated Glass.
 - 4. ASTM C1172 Standard Specification for Laminated Architectural Flat Glass.
 - ASTM C1376 Standard Specification for Pyrolitic and Vacuum Deposition Coatings on Flat Glass.
 - 6. ASTM E2188 Standard Test Method for Insulating Glass Unit Performance.
 - 7. ASTM E2189 Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
 - 8. ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.

1.04 QUALITY ASSURANCE

A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

- B. Source Limitation for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- C. Glass Product Testing: Obtain glass test results for product test reports in Submittals Article from a qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program
- D. Safety Glazing Labeling: Permanently mark glazing with certification label indicating manufacturer's name, type of glass, glass thickness and safety glazing standard with which glass complies.
- E. Installer Qualifications: An experienced installer who has completed glazing similar in material, design and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Provide for each glass type:
 - 1. Latest edition of manufacturer's Technical Data including structural, physical and environmental characteristics, size limitations, and special handling or installation requirements.
 - 2. Product Certificates from manufacturer.
 - 3. Product Test Reports for: Tinted Float Glass, Coated Float Glass, and Insulating Glass.
 - 4. Submit two, 12"x12" samples, illustrating glass unit and coloration.
- D. Provide data, including VOC content on glazing sealant. Identify colors available.
- E. Provide shop drawings: Submit shop drawings showing layout, profiled and product components.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

1.09 OPERATION AND MAINTENANCE DATA

Not required.

1.10 EXTRA MATERIALS

Not required.

1.11 RECORD DRAWINGS

Not required.

1.12 WARRANTY

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Contractor shall guarantee the work covered by this specification against all defects in material and workmanship for a period of not less than FIVE (5) years. Include coverage of sealed glass units from seal failure, interpane dusting or misting, and replacement.

PART 2 – PRODUCTS

2.01 ACCEPTABLE GLASS MANUFACTURERS

- A. Insulated, Laminated, and Spandrel Glass: Vitro Architectural Glass (formerly PPG Industries), Tel: (800) 377-5267, Website: www.vitroglazings.com.
- B. Security Glazing: Nippon Electric Glass Company, Ltd.; Tel: (800) 426-0279.
- C. Fire-Rated Clear Window and/or Door/Sidelight Glazing: SAFTI FIRST, Tel: (888) 653-3333, Website www.safti.com.
- D. Spandrel Coatings: ICD High Performance Coatings, Tel: (360) 546-2286, website: www.icdcoatings.com.

2.02 GLASS MATERIALS

- A. General Performance Requirement: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.
- B. GE-1: Exterior Glazing Type 1, Insulated Glass Units.
 - 1. Unit Makeup: Double pane of 1/4" (6mm) outboard lite and 1/4" (6mm) inboard lite with edge seal; 1/2" (12mm) spacer purged with dry hermetic air; total unit thickness of 1 inch.
 - 2. Glass Strength: Tempered as required by codes or as required to meet thermal stress and wind loads.
 - 3. Coating: Low-E Coating on inside of outer layer (#2 surface).

- 4. Tinting: As indicated on the Drawings.
- 5. Spandrel Coating: As indicated on the Drawings.
- 6. Performance values based on combination of coating and/or tint selected.
- C. GI-1: Interior Glazing Type 1
 - 1. Unit Makeup: Monolithic pane of 1/4" (6mm) lite.
 - 2. Glass Strength: Tempered (Grade B)
 - 3. Style: Clear, Uncoated, Type I (float or plate).
- D. GI-2: Interior Glazing Type 2, Fire-Rated
 - 1. Unit Makeup: Monolithic pane as required per Fire-Rated Assembly.
 - a. Nominal thickness per Fire Rating:
 - i. 1/4" (6mm) = 20 minute
 - ii. 3/4" (19mm) = 45 minute
 - iii. 7/8" (23mm) = 60 minute
 - iv. 1 7/16" (37mm) = 90 minute
 - v. 2 1/8" (54mm) = 120 minute
 - 2. Glass Strength: Tempered. Safety rated in accordance with ANSI Z97.1 and CPSC 16 CFR 1201 Cat. I & II.
 - 3. Style: Clear, float glass.
 - 4. Fire protective tested in accordance with NFPA 80, NFPA 252, NFPA 257, UL 9, UL 10B and UL10C.
- E. GI-3: Interior Glazing Type 3, Wired
 - 1. Unit Makeup: Monolithic pane of 1/4" (6mm) nominal thickness.
 - 2. Glass Strength: Safety rated in accordance with ANSI Z97.1 and CPSC 16 CFR 1201 Cat. I & II.
 - 3. Style: Clear, wired with manufacturer's standard diamond or square pattern.
 - 4. Provide fire-rated panes as required per Fire-Rated Assembly. Note: Wired glass products do not meet ASTM E119 or NFPA 251.
- F. GI-4: Interior Glazing Type 4, Laminated
 - Unit Makeup: 5/16" (7mm) thick Two-Ply Laminated Glass comprised of a 1/8" (3mm) outer ply, 1/8" (3mm) inner ply and an interlayer of 0.030" polyvinyl butyral (PVB) sheet. Product to be fabricated in autoclave with heat, plus pressure, free of foreign substances and air pockets.
 - 2. Glass Strength: Chemically strengthened. Safety rated in accordance with ANSI Z97.1 and CPSC 16 CFR 1201 Cat. I & II.
 - 3. Style: Clear, unless noted otherwise.
- G. GI-5: Interior Bullet-resistant Glazing (typical unless noted otherwise in separate Section)
 - 1. Unit Makeup: Four-ply polycarbonate laminate comprised of a 1/8" (3mm) abrasion resistant polycarbonate sheet outer ply, two 1/2" (12mm) polycarbonate intermediate sheets, 1/8" (3mm) abrasion resistant polycarbonate sheet inner ply with a interlayer of .025 polyurethane between each ply.
 - 2. Style: Clear, unless noted otherwise.

3. Ballistic rating Level 3 in accordance with UL 752.

2.03 GLAZING ACCESSORIES

- A. Select appropriate glazing sealants, tapes, gaskets and other glazing materials of proven compatibility with other materials that they contact. These include glass products, insulating glass unit seals and glazing channel substrates under installation and service conditions, as demonstrated by testing and field experience. Provide fire-rated products approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection rating indicated.
- B. Glazing Compound: Modified oil type, non-hardening, knife grade consistency.
- C. Butyl Sealant: Single component; Shore-A hardness of 10-20; black color; non-skinning.
- D. Acrylic Sealant: Single component, solvent curing, cured Shore hardness, non-bleeding.
- E. Silicone Sealant: Single component, non-bleeding, non-staining; capable of water immersion without loss of properties.
- F. Setting Blocks: Neoprene; 80-90 Shore A durometer hardness; 4 inch minimum long x 1/4 inch thick.
- G. Spacer Shims: Neoprene; 40-50 Shore A durometer hardness; 4 inch long on 18 inch centers for wet-glazed systems.
- H. Glazing Clips: Manufacturer's standard type.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the area and conditions under which work of this Section will be performed and confirm site conditions are acceptable for installation of the glass.
- B. Coordinate work with other trades as needed to assure that proper substrate are provided to receive work of this Section.
- C. Verify openings for glazing are correctly sized and within tolerance.
- D. Verify surfaces of glazing channels or recesses are clean, square in plane, free of obstructions, and ready for work of this Section.
- E. Verify that a functioning weep system is present.
- F. Correct conditions detrimental to timely and proper completion of the Work.
- G. Do not proceed until unsatisfactory conditions are corrected.
- H. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

- A. Protect glazing products by handling and storing units according to manufacturer's recommendations.
- B. Clean and prepare glazing channels and other framing members to receive glass.
- C. Remove coatings and other harmful materials that will prevent glass and glazing installation required to comply with performance criteria specified.
- D. Seal porous glazing channels or recesses.

3.03 EXTERIOR WET METHOD (SEALANT AND SEALANT)

A. Place setting blocks at 1/4 points and install glass pane.

- B. Install removable stops with pane centered in space by inserting spacer shims both sides at 18-inch intervals, 1/4 inch below sightline.
- C. Fill gap between pane and stops with sealant to depth equal to bite of frame on pane, but not more than 3/8 inch below sightline.
- D. Apply sealant to uniform line, flush with sightline. Tool or wipe sealant surface with solvent for smooth appearance. Security Glazing to be sealed with security sealant as recommended by manufacturer.
- E. Drain or weep the sill of each opening to the outdoors at three points using 3/8-inch diameter weep holes or the equivalent.

3.04 INTERIOR COMBINATION METHOD (TAPE AND SEALANT)

- A. Cut glazing tape to length and install against permanent stops, project 1/16 inch above sightline.
- B. Place setting blocks at 1/4 points.
- C. Rest glass on setting blocks and push against tape to ensure full contact at perimeter of pane.
- D. Install: removable stops, spacer shims between glass, and applied stops at 18-inch intervals 1/4 inch below sightline.
- E. Fill gap between pane and applied stop with sealant to depth equal to bite of frame on pane to uniform and level line.
- F. Trim protruding tape edge.

3.05 INTERIOR WET METHOD (COMPOUND AND COMPOUND)

- A. Install glass resting on setting blocks. Install applied stop and center pane by use of spacer shims at 18-inch centers, kept 1/4 inch below sightline.
- B. Locate and secure glass pane using glaziers' clips.
- C. Fill gaps between pane and stops with glazing compound until flush with sightline.

3.06 <u>CLEANING</u>

- A. After installation, mark pane with an "X" by using plastic tape or removable paste.
- B. Remove glazing materials from finish surfaces.
- C. Remove labels after work is completed.
- D. Clean excess sealant or compound from glass and framing members immediately after application using solvents or cleaners recommended by manufacturers. Final cleaning and polishing shall be done prior to final inspection.
- E. Do not use scrapers or other metal tools to clean glass.
- F. Remove and replace broken, scratched, chipped or otherwise defective glass with new materials and leave the entire installation in a neat, clean, and acceptable condition.

END OF SECTION
SECTION 09 05 61.13

MOISTURE VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Pre-formed moisture suppression membrane installed over concrete subfloor as a floor covering underlayment.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Coordinate the work of this section and directly related sections with concrete floor construction and repair.
- D. Coordinate the work of this section and directly related sections with finish flooring work.

1.03 STANDARDS AND REFERENCES

ASTM International

- A. D2646-05- Standard test Methods for Backing Fabric Characteristics of Pile Yarn Floor Coverings
- B. D3273-00- Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
- C. D5729-97 (2004)e1 Standard Test Method for Thickness of Nonwoven Fabrics
- D. E-96-05 Standard Test Methods for Water Vapor Transmission of Materials
- E. F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
- F. F 710 Standard Practice Preparing Concrete Floors

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop

Drawings and Samples.

- C. Product Data: Provide data indicating any product characteristics, performance criteria, and limitations of use.
- D. Manufacturer's Current Instructions.
- E. Manufacturer's warranty registration with concrete subfloor moisture test results and building ambient air temperature and relative humidity test results.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

- 2.01 <u>MANUFACTURER</u>
 - A. Basis of Design: GCP Applied Technologies Inc. Kovara 95 & MBX (formerly VersaShield 95 & VersaShield MBX). Location: 62 Whittemore Avenue, Cambridge, MA 02140. Phone: 866-333-3726. Website: www.gcpat.com
 - B. Or Architect approved equal.

2.02 MOISTURE SUPPRESSION SYSTEM FOR FLOORING PRODUCTS

- A. Product name: Kovara 95 Flooring Underlayment and Kovara MBX Flooring Underlayment.
 - 1. Material: Free-standing, dimensionally stable, 4-ply composite product, engineered as a moisture suppression membrane to be used on concrete floors where high moisture exists.
 - 2. Dimensions: 144 ft. long by 5 ft. wide standard roll.
 - 3. Mold, Mildew & Fungal Resistance, ASTM D3273: 10 rating
 - 4. Moisture Vapor Transmission rate, ASTM E96-05: less than 0.01 g/hr/sq m

- B. Accessories: Kovara Double-Sided Seam Tape
 - 1. Application: Joining of moisture suppression underlayment seams.
 - 2. Description: Membrane manufacturer's moisture suppression tape with double-sided pressure sensitive adhesive for use over slabs with a maximum relative humidity of 99.5 percent and maximum pH of 12.
 - 3. Properties: Moisture suppression and adhesion per manufacturer's specifications.
 - 4. Dimensions: 4 inch wide by 100 feet long roll.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify internal RH of the Concrete Sub Floor according to ASTM F-2170.
 - 1. Record readings and submit with manufacturer's warranty registration.
 - 2. Kovara 95: Do not install if relative humidity levels within the concrete exceed 95% Relative Humidity.
 - 3. Kovara MBX: Do not install if relative humidity levels within the concrete exceed 99% Relative Humidity.

3.02 PREPARATION

New or Remedial Installation - Concrete Sub Floor:

- A. Prepare floor according to Kovara 95 or Kovara MBX manufacturer's instructions including removal of existing materials on concrete surface, grinding protrusions flat, and filling low spots with water-resistant cementitious patching or leveling compound. Patch cracks greater than 1/8-in. width using VersaShield manufacturer's approved crack mending compound.
- B. Remove debris and excessive dust from the surface.

3.03 UNDERLAYMENT INSTALLATION

- A. Install moisture suppression membrane with smooth film side facing concrete slab.
- B. Install in accordance with membrane manufacturer's current written installation instructions.
- C. If any jobsite condition interferes with compliance with manufacturer's instructions, contact manufacturer and obtain written job-specific procedures. Notify architect or owner's representative as required in the Quality Section of this project manual describing the interfering jobsite condition and manufacturer's job-specific instructions.

3.04 FLOORING INSTALLATION

- A. Adhesives Apply adhesive to mineral-coated surface of moisture suppression membrane. Use only water-based adhesives. Do not use solvent-based adhesives.
- B. Protection Protect moisture suppression membrane from damage during flooring installation. Do not tear, rip, puncture, or delaminate membrane when applying trowel-on adhesive. Repair damaged areas according to membrane manufacturer's instructions before flooring installation. Provide continuous, intact moisture suppression membrane under entire designated flooring area.
- C. Install flooring according to flooring manufacturer's instructions
 - 1. Laminate or Engineered Wood: Install according to manufacturer's instructions for floating floors.

- 2. Broadloom Carpet or Carpet Tiles: Adhere directly to moisture suppression membrane using carpet manufacturer's recommended adhesive.
- 3. Vinyl Tile: Adhere directly to moisture suppression membrane using tile manufacturer's recommended adhesive.
- 4. Ceramic Tile: Adhere only to approved surfaces concrete, plywood, precast flooring, gypcrete, radiant heated floors, existing well-bonded vinyl, VCT, LVT, LVP, metal floors, and chemically treated or contaminated surfaces.
- D. Not approved for unitary back direct glue wide width carpet, linoleum, rubber tile, sheet vinyl, mechanically fastened solid wood.

END OF SECTION

SECTION 09 21 13

PLASTER ASSEMBLIES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Lath and Plaster Work as shown on the Drawings and as specified herein, for a complete and proper installation.

1.03 STANDARDS AND REFERENCES

Comply with all applicable requirements of the California Lathing and Plastering Contractor's Association "Reference Specifications" except where more stringent requirements are indicated herein or in local building codes.

1.04 QUALITY ASSURANCE

- A. In all Work under this Section, coordinate with all other trades whose work connects with, is affected or concealed by lathing and plastering. Before proceeding, make certain all required inspections have been made. Do all cutting and patching required to accommodate the work of other trades.
- B. Inspect surfaces to receive lath and plaster before starting Work and do not start until surfaces are acceptable. Starting Work under this Section implies acceptance of surfaces.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Submit Product Data and color samples and manufacturers application data.
- D. Make (2) samples, at least one-foot square, of selected specified plaster system.

1.07 DELIVERY, STORAGE AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.9 EXTRA MATERIALS

Not required.

1.10 <u>RECORD DRAWINGS</u>

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 <u>LATH</u>

Paperbacked Lath: K-Lath Corporation: "Aqua K-Lath", or as approved by Architect, 16 gauge wires spaced 1-1/2 inches o.c. vertically and welded to 16 gauge wires spaced 2 inches o.c. horizontally, with perforated Kraft paper to insure plaster embedment and Type I Class B waterproof building paper laminated to back side.

2.02 <u>ACCESSORIES</u>

- A. Corner Bead: #1X Type, Keene or equal, expanded metal flanges integral with nose bead of solid metal, galvanized.
- B. Corner Lath: As specified for expanded metal, three (3) inch legs bent to a 105-degree corner, "Cornemaster #30" by Keene, or equal.
- C. Casing Beads: #66 Type, Western, or equal, expanded metal flange, galvanized, depth as required by plaster thickness, weighing approximately 200# per 1000 lineal feet for 3/4-inch and 7/8-inch types.
- D. Expansion Joints: #15 by Keene or equal. Cut lath passing under expansion joints. Install where indicated on Drawings, with the following minimum conditions:
 - 1. No length should be greater than 18 feet in either direction
 - 2. No panel shall exceed a maximum of 144 square-feet for vertical applications.
 - 3. No panel shall exceed a maximum of 100 square-feet for horizontal, curved or angular sections.
 - 4. No length-to-width ratio should exceed 2.5 to 1 in any given panel.
- E. Bonding Agent: As recommended for application over smooth monolithic concrete shells. Concrete shells shall be cleaned with bonding agent applied prior to plastering interior.
- F. Wire: Soft, annealed, galvanized steel, 8-gauge for hangers, 16-gauge for channel ties and 18-gauge for lath ties.
- G. Nails: Concrete nails, case hardened steel, 3/4 inch long.
- H. Weep Screed: by Keene or equal. 1-1/4" ground, galvanized.

- I. Building Paper: 15#, asphalt impregnated. Install over Weather Barrier specified in Section 07 25 00 and shown on the Drawings.
- J. Miscellaneous Items: Furnish all miscellaneous components not specified herein but shown on the Drawings and any other items required to complete the installation.
- K. Water: Clean and free of deleterious matter.

2.03 PORTLAND CEMENT PLASTER

- A. Portland Cement: Conforming to ASTM C-150, Type 1.
- B. Sand for Cement Plaster: Conforming to ASA A42.2.
- C. Hydrated Lime: Conforming to ASTM C-206, Type S.
- D. Quick Lime: Conforming to ASTM C-5.
- E. Exterior Cement Plaster:
 - 1. Scratch Coat: One part Portland Cement, four (4) parts sand and hydrated lime equal to 25% volume of cement.
 - 2. Brown Coat: One part Portland Cement, five parts sand and hydrated lime equal to 25% of the volume of cement.
 - 3. Finish Coat: Portland Cement-Lime: one part standard Portland Cement, not more than 1/2 part dry hydrated lime (or an equivalent amount of lime putty) and not more than one part #20 mesh, and one part #16 mesh silica sand. Submit finish sample(s) for Architect's approval.
 - 4. Thickness: 7/8 inch thick, measured from back of lath.
 - 5. Finish coat to contain integral color. Submit samples to Architect for approval based upon colors indicated on Drawings.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and condition under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 <u>GENERAL</u>

- A. Coordinate work with other trades as needed to assure that proper substrate are provided to receive work of this Section.
- B. Provide ventilation to properly dry plaster during and subsequent to application. In glazed areas, accomplish by keeping windows open sufficiently to provide air circulation; in enclosed areas lacing normal ventilation, mechanically remove moisture-laden air.

3.03 LATHING

- A. Apply lath with long dimension at right angles to supports; lap side and ends as recommended by manufacturer. Stagger vertical laps. Make no vertical joints at any corner; bend lath around all corners, internal and external.
- B. Attach lath to studs by fasteners at spacings required by local building codes. All attachments to be corrosion resistant.

- C. Install all accessories to plumb, true and level lines, and backing plates as located by the trade furnishing these items.
- D. Install beads, corner laths, control joints, reglets, screeds, and like items, using single lengths wherever possible. Provide corner beads at all exterior corners shown, mitering or coping as required, and fastening at six (6) inches o.c., both sides. Provide casing beads wherever interior plaster angles are shown and wherever one or both abutting surfaces are metal lathed, except corner laths are not required where metal lath is continuous around corner at junctions of walls, or where ceiling lath turns down a wall. Tie outer edges only to adjoining lath at six (6) inches o.c. or stub nail to any concrete. Install access panels supplied by other trades.
- E. Start installation at bottom of wall, working up and from right to left. Apply lath with long dimension at right angles to supports; lap sides and ends as recommended by manufacturer. Stagger vertical laps. Make no vertical joints at any corner; bend lath around all corners, internal and external.
- F. Attach lath to metal and/or wood studs by means of tie wire and nails respectively at spacings as required by Local Building Codes. All attachments shall be corrosion resistant.
- G. Install corner beads at all external corners. Use single length except where standard length is not sufficient. Miter or cope as required; fasten with tie wire at six (6) inches o.c., both sides.
- H. Install at interior angles and sheer one or both abutting surfaces are metal lath. Corner laths are not required where metal lath is continued around corner at junction of walls and where ceiling lath turns down wall unless otherwise noted on drawings. The outer edges only to adjoining lath at six (6) inches o.c., or stub nail to concrete.

3.04 PLASTERING

- A. Do not apply plaster below 55 degrees F temperature. Apply no plaster to frosty surfaces. Dampen any surfaces on which suction must be reduced with fog-spray. Maintain all screeds plumb and true.
- B. Except when had mixing small batches is approved, use approved mechanical mixers. Clean mixers, mixing boxes and tools after mixing each batch. Thoroughly mix with water until uniform in color and consistency. Retempering not permitted. Discard plaster, which has begun to stiffen. Mix in strict accordance with manufacturer's printed directions.
- C. Except in the case of specifically formulated plasters, which require only water added job site, proportion by volume as specified.
- D. Scratch coat: Apply with sufficient material and pressure to shove material through metal lath and form a good key; 3/8 inch minimum thickness, score in horizontal direction with metal scorer with clipped teeth to provide good mechanical key for second coat. Dampen concrete and concrete block surfaces to reduce suction prior to application.
- E. Brown coat: Apply not sooner than 48 hours after application of scratch coat; properly dampen scratch coat; apply sufficient pressure to force plaster into scratches and build out to within 1/8 inch to screeds; for, float and darby to true, plumb surfaces and corners; leave rough for finish coat.
- F. Curing: Keep Brown coat moist for at least 48 hours; commence moistening as soon as plaster has hardened sufficiently so to prevent injury; apply water in a fine fog spray; avoid soaking; curing shall proceed over holidays, Saturdays and Sundays if necessary. If atmospheric conditions are hot and dry, curing time shall be extended as necessary at no additional cost to Owner. Allow plaster base coats to cure for a minimum of fourteen (14) days before applying finish coat.
- G. Finish coats Apply to partially dry base coat, or to a thoroughly dry base coat that has been evenly wetted by brushing or spraying; avoid use of excessive water. Trowel all finish

surfaces of plaster to perfectly true and even surface without scratches, ridges, voids, cracks, etc. Fill fissures or breaks in brown coat and existing plaster before application of finish coat. Make coats uniform in thickness with average thickness about 1/8 inch; minimum thickness anywhere: 1/16 inch.

3.05 CLEANING AND PATCHING

- A. A clean floor of droppings immediately after each coat is applied. At any exterior locations, remove droppings or splashes from all concrete, masonry or other finish surfaces.
- B. Patch after all other Work, except painting, has been completed. Cut out damaged or broken plaster to straight lines with clean, sharp edges. Cut out cracks to width of at least one (1) inch. Fill areas to be patched with base materials, and then give a finish coat of same material as adjoining plaster. Patched areas shall match adjoining work in finish and texture. Joining shall be flush and smooth so joints between patch and existing plaster are not noticeable.
- C. At completion of Work, remove excess plaster from beads, screeds, etc., and leave Work clean and ready for painting. Promptly remove plaster, rubbish, surplus material, scaffolding and other equipment from job site. Leave areas broom clean.

END OF SECTION

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SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Gypsum Board Products, as shown on Drawings and as specified herein, including all accessories and labor for a timely, complete, and proper installation

- A. Fire-Resistance Rated Gypsum Board
- B. Mold and Moisture Resistant Gypsum Board
- C. Fire-Resistance, Mold and Moisture Resistant Gypsum Board
- D. Cement Board
- E. Impact Resistant Gypsum Board

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- 1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MANUFACTURER / PRODUCTS

- A. Basis of Design: Products of National Gypsum Company
- B. Acceptable Alternates: Georgia-Pacific, US Gypsum or Architect approved equal.

2.02 FIRE-RESISTANCE RATED GYPSUM BOARD

- A. Basis of Design: Gold Bond® BRAND Fire-Shield C Gypsum Board.
- B. Panel Physical Characteristics:
 - 1. Core: Enhanced fire-resistance rated gypsum core
 - 2. Surface paper: 100% recycled content paper on front, back and long edges
 - 3. Long Edges: Square or Tapered at Contractor's discretion.
 - 4. Overall thickness: 5/8 inch.
 - 5. Panel complies with Type X requirements of ASTM C 1396 Standard Specification for Gypsum Board

2.03 MOLD AND MOISTURE RESISTANT GYPSUM BOARD

- A. Basis of Design: Gold Bond® BRAND XP® Gypsum Board
- B. Panel Physical Characteristics
 - 1. Core: Mold and moisture resistant gypsum core.
 - 2. Surface paper: 100% recycled content moisture/mold/mildew resistant paper on front, back, and long edges.
 - 3. Long Edges: Square or Tapered at Contractor's discretion.
 - 4. Overall thickness: 5/8 inch.
 - 5. Panel complies with requirements of ASTM C 1396 Standard Specification for Gypsum Board.
 - Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

2.04 <u>FIRE-RESISTANCE RATED GYPSUM BOARD WITH ENHANCED MOLD AND MILDEW</u> <u>RESISTANCE</u>

- A. Basis of Design: Gold Bond® BRAND XP® Fire-Shield® C Gypsum Board
- B. Type C, Panel Physical Characteristics
 - 1. Core: Mold and moisture resistant, with enhanced fire-resistance rated gypsum core
 - 2. Surface paper: 100% recycled content moisture/mold/mildew paper on front, back and long edges
 - 3. Long Edges: Square or Tapered at Contractor's discretion.
 - 4. Overall thickness: 5/8 inch.
 - 5. Panel complies with requirements Type X of ASTM C 1396 Standard Specification for Gypsum Board
 - 6. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

2.05 <u>CEMENT BOARD</u>

- A. Cement Backerboard
 - 1. Basis of Design: PermaBase® BRAND Cement Board
 - 2. Panel Physical Characteristics
 - a. Core: Cementitious, water-durable
 - b. Surface: Fiberglass mesh on front and back
 - c. Long Edges: Tapered
 - d. Overall Thickness: 5/8 inch.
 - Panel complies with requirements of ASTM C 1325 Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units and ANSI A118.9
 - f. Density: 72 lbs. per cu. ft.
 - g. Water Absorption: Not greater than 8% when tested for 24 hours in accordance with ASTM C 473 Standard Test Methods for Physical Testing of Gypsum Panel Products
- B. Cement Board Underlayment
 - 1. Basis of Design: PermaBase® BRAND Cement Board
 - 2. Panel Physical Characteristics
 - a. Core: Cementitious, water-durable
 - b. Surface: Fiberglass mesh on front and back
 - c. Long Edges: Tapered
 - d. Overall Thickness: 1/4 inch
 - e. Panel complies with requirements of ASTM C 1325 and ANSI A118.9
 - f. Density: 72 lbs per cu. ft.
 - g. Water Absorption: Not greater than 8% when tested for 24 hours in accordance with ASTM C 473 Standard Test Methods for Physical Testing of Gypsum Panel Products

2.06 HIGH IMPACT GYPSUM BOARD

- A. Basis of Design: Gold Bond® BRAND Hi-Impact® XP® Gypsum Board
 - 1. Performance Criteria Wall Assembly STC: 40
 - 2. Panel Physical Characteristics
 - a. Core: Fire-resistance rated gypsum core, with additives to enhance mold/mildew resistance, surface indentation resistance, impact resistance and moisture and mold resistant
 - b. Surface paper: Abrasion resistant, 100 percent recycled content moisture/mold/mildew resistant paper on front, back and long edges
 - c. Embedded fiberglass mesh
 - d. Long Edges: Tapered
 - e. Overall thickness: 5/8 inch
 - f. Panel complies with Type X requirements of ASTM C 1396
 - g. Surface Abrasion Resistance: Classification Level 3 in accordance with ASTM C 1629
 - h. Indentation Resistance: Classification Level 1 in accordance with ASTM C 1629.
 - i. Soft Body Impact Resistance: Classification Level 3 in accordance with ASTM C 1629
 - j. Hard Body Impact Resistance: Classification Level 3 in accordance with ASTM C 1629.
 - k. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273.

2.07 ACCESSORY PRODUCTS

- A. Acoustical sealant
 - 1. Conform to ASTM C 919 Standard Practice for Use of Sealants in Acoustical Applications
 - 2. Products/Manufacturer
 - a. Grabber Acoustical Sealant GSC
 - b. STI SpecSeal Smoke N Sound Caulk
 - c. BOSS 824 Acoustical Sound Sealant
- B. Firestopping
 - 1. Conform to ASTM E 90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
 - 2. Products/Manufacturer
 - a. STI SpecSeal SSP Putty Pads
 - b. BOSS 818 Fire Rated Putty Pads
- C. Fasteners for use with 5/8 inch thick tile backer panels: As recommended by Manufacturer.
- D. Fasteners for use with Cement Board:
 - 1. PermaBase Cement Board Hi-Lo thread screws (No. 8).
 - 2. Wafer head, corrosion-resistant.

- 3. Overall Thickness: As recommended by Manufacturer.
- 4. For use with wood framing and complying with ASTM C 1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- E. Joint Treatment
 - 1. Tape As recommended by Manufacturer:
 - a. Paper Tape: 2-1/16 inches wide.
 - b. Paper Tape: 2 inches wide with metal strips laminated along the center crease to form inside and outside corners.
 - c. Fiberglass Tape: Nominal 2 inches wide self-adhering tape.
 - d. Alkali-resistant Fiberglass Tape: Nominal 2 inches wide polymer coated alkali-resistant mesh tape.
 - 2. Drying Type Compound As recommended by Manufacturer:
 - a. Ready Mix vinyl base compound.
 - b. Ready Mix vinyl base compound formulated for enhanced mold and mildew resistance.
 - c. Ready Mix vinyl base compound formulated to reduce airborne dust during sanding.
 - d. Ready Mix vinyl base topping compound for finish coating.
 - e. Ready Mix vinyl base compound for embedding joint tape, corner beads or other accessories.
 - f. Field Mix vinyl base compound.
 - 3. Setting Compound As recommended by Manufacturer:
 - a. Field mixed hardening compound.
 - b. Field mixed hardening compound for fire resistance rated construction and penetrations.
 - 4. Joint Sealant: Conform to ASTM C920 Standard Specification for Elastomeric Joint Sealants.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive gypsum products to verify conditions.
- B. Report conditions contrary to contract requirements that would prevent a proper installation.
- C. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- D. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the conditions.
- E. Installation indicates acceptance of the conditions with regard to conditions existing at the time of installation.
- 3.02 APPLYING AND FINISHING PANELS, GENERAL
 - A. Comply with ASTM C 840, GA-216 or GA-214.

- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panel not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 to 3/8 inch (6 to 9 mm) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4 to ½ inch (6 to 12 mm) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.03 INSTALLATION, INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Regular Type: Vertical or horizontal surfaces, unless otherwise indicated.
 - 2. Type X: Where required for fire-resistance-rated assembly.
 - 3. Type C: Where required for specific fire-resistance-rated assembly indicated.
 - 4. Ceiling Type: Ceiling surfaces.
 - 5. Moisture and Mold-Resistant Type: Areas with limited exposure to water.
 - 6. High Impact Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 - On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

- 3. On furring members, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
- 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
 - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - 3. On furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - 4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.04 INSTALLATION, CEMENT BOARD PANELS

- A. Install in accordance with manufacturer recommendation and ANSI A108.11.
- B. Install where tile finish is indicated in the Drawings.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.05 INSTALLATION, TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings and if not shown according to ASTM C 840 or GA-216 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations
 - 1. Cornerbead: Use at outside corners, unless otherwise indicated. Install standard 90 degree cornerbeads where corner guards and chair rails are to be installed.
 - 2. LC-Bead: Use at exposed panel edges.

3.06 FINISHING GYPSUM BOARD

Provide a Level 4 Finish, with a light orange-peel texture. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compounds

shall be smooth and free from tool marks and ridges. The prepared surface shall be coated with Sheet Rock Brand First Coat Primer, or equal, prior to the application of the light orange-peel texture.

3.07 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 30 00

<u>TILING</u>

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all materials and labor, as shown on Drawings and as specified herein, including all accessories and hardware for a timely, complete, and proper installation.

- A. Porcelain and Ceramic Tile
- B. Floor and Wall Glazed.
- C. Wall Glazed.
- D. Trim and Accessories.
- E. Setting Materials.

1.03 STANDARDS AND REFERENCES

- A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Certificate of grade: Submit for approval, with each delivery, manufacturer's grade certificate in conformance with Tile Manufacturers Association, certifying grade, type and quality of tile furnished.
- C. Dynamic Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ANSI 137.1.
- D. Tile delivered in sealed cartons identified with grade certificate.
- E. Cartons of tile kept dry until tiles are removed, tile prevent from staining.
- F. All tile free from chips, cracks, scratches, pits or other defects.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products of this section with minimum ten years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum of five years' documented experience.
- C. Single Source Responsibility: Obtain each type and color of tile from a single source. Obtain each type and color of mortar, adhesive and grout from the same source.
- D. Performance Requirements: Dynamic Coefficient of Friction (DCOF): Provide floor tiles at interior level spaces with a wet dynamic coefficient of friction value of 0.42 or greater when tested in accordance with ANSI A137.1-2012 standard for ceramic tile.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's Specifications, catalog cuts, and other data needed to prove compliance with the specified requirements of tile, sealants, grout, trim, fasteners, adhesives and sealers.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- D. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- E. Selection Samples: Samples of actual tiles for selection.
- F. Samples: Mount tile and apply grout on two plywood panels, illustrating pattern, color variations, and grout joint size variations.
- G. Manufacturer's Certificate:
 - 1. Certify that products meet or exceed specified requirements.
 - 2. For each shipment, type and composition of tile provide a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.
- H. Results of compliance of Flooring Substrate for requirements of Moisture & PH Testing prior to installation in accordance with Section 07 05 00.
- I. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Locate mock-ups on site in locations and size directed by Architect. The mock-up may be part of the work and may be incorporated into the finish when so accepted by the architect.
 - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.
 - 4. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed unit of Work.
 - 5. Obtain Architect's acceptance of mock-ups before start of final unit of Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 -

Services, Materials and Equipment.

- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements of ANSI A137.1 for labeling sealed tile packages.
- D. Prevent damage or contamination to materials by water, freezing, foreign matter and other causes.
- E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Environmental: Install mortar, set and grout tile when surfaces and ambient temperature is minimum 50 degrees F (10 degrees C) and maximum 90 degrees F (32 degrees C). Consult with manufacturer for specific requirements.
- C. Do not install mortar, set or grout tile exterior when inclement weather conditions are expected within 48 hours after work is completed unless properly protected.
- D. Protection: Protect adjacent work surfaces during tile work. Close rooms or spaces to traffic of all types until mortar and grout have set.
- E. Safety: Observe the manufacturer's safety instructions including those pertaining to ventilation.

1.09 OPERATION AND MAINTENANCE DATA

- A. Provide in accordance with Project Manual Volume One, Article 6.12 Record Documents.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Provide in accordance with Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- D. Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.10 EXTRA MATERIALS

- A. Provide in accordance with Project Manual Volume Four, Section 01 78 00.
- B. Provide for Owner's use a minimum of 2 percent, but not less than one box, of the each of the sizes and colors of tile specified, boxed and clearly labeled.

1.11 RECORD DRAWINGS

Not required.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2- PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Emser Stone and Tile, www.emser.com Contact: Lori Fisher (Architectural Sales Representative) at (760) 834-2095, lorifisher@emser.com.
 - 2. Daltile, www.daltile.com Contact: Christina Regan (Architectural Sales Representative) at (909) 844-7186, Christina.regan@daltile.com.
 - 3. Arizona Tile, www.arizonatile.com Contact: Phil York (Architectural Sales Representative) at (760) 321-2005, pyork@arizonatile.com.
- B. Tile: Standard grade, meeting the simplified Practice Recommendations F61-61, also Fed. Spec. SS-T-308B and ANSI A-137.1. Cartons grade sealed.

2.02 <u>TILE</u>

- A. General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types colors and pattern indicated on the Drawings and identified in the Schedule and the end of this Section. Tile shall also be provided in accordance with the following:
 - 1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
 - 2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.
 - 3. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.

B. Material:

- 1. Furnish: size(s), color(s), pattern(s) and shape(s) as indicated on the drawings.
- 2. Trim Units: Matching bullnose, cove/inside finger cove, radius cap, sink rail, sink rail incorner/outcorner, cement bullnose, cove base, fabric bullnose, grooved bullnose, jolly shapes in sizes coordinated with field tile
- 3. Provide standard accessory shapes as required and as accepted by Architect.
- 4. Use appropriate trim shapes to conform to drawings.
- 5. Metal trims shall have a clear anodized finish protected as to resist discoloration from adhesives and grouts.
- 6. Floor Tile: Shall meet the static coefficient of friction (COF) prescribed by ADAAG 0.6 for level floors and 0.8 for ramps.

2.03 TRIM AND ACCESSORIES

Non-Ceramic Trim: Satin natural anodized extruded aluminum, stainless steel, brass, etc., style and dimensions to suit application, for setting using tile mortar or adhesive; use in the following locations:

- A. Product: as indicated on the drawings.
- B. Open edges of floor tile.
- C. Transition between floor finishes of different heights.

- D. Thresholds at door openings.
- E. Expansion and control joints, floor and wall.

2.04 SETTING MATERIALS

- A. Membranes: Liquid applied waterproof/crack isolation membrane (For Cracks Up To 1/8"):
 - 1. Basis: Custom Building Products RedGard waterproof/crack isolation membrane.
 - 2. Acceptable Products: Laticrete International Hydro Ban Floor and Wall Waterproofing & Crack Isolation & MAPEI Mapelastic AquaDefense.
- B. Bonding Materials:
 - 1. Bonded Mortar Bed Installations: Where indicated on the drawings, and elsewhere as required for mortar bed or brown coat as the substrate for tile work; work to conform to ANSI A108.1.
 - a. Portland cement: ASTM C 150, Type 1.
 - b. Sand: ASTM C 144.
 - c. Water: Potable, fresh.
 - d. Setting bed reinforcing mesh: 2-inch by 2-inch by 16/16, 3-inch by 3-inch by 13/13 or 1-1/2-inch by 2-inch by 16/13 wire complying with ASTM A 82 or A 185.
 - e. Latex modified dry-set mortar: The following or equal with physical properties equaling or exceeding those of the products specified.
 - f. Mortar Bed Bonding Mortar; Custom Building Products VersaBond mortar bed bonding mortar.
 - 2. Medium Bed/Thin Set (Non Slumping) Mortar:
 - a. Basis: Custom Building Products ProLite polymer modified thin set/medium bed mortar.
 - b. Acceptable Products: Laticrete International 255 MultiMax or MAPEI Large Floor Tile Mortar
- C. Grout:
 - 1. Portland cement grout:
 - a. Basis: Custom Building Products Polyblend Sanded Grout, ANSI A118.7 for joints 1/8 inch to 1/2 inch.
 - b. Acceptable Products: Laticrete International PermaColor Grout or MAPEI Ultracolor Plus Grout
 - 2. Epoxy Grout
 - a. Basis: Custom Building Products CEG-Lite Epoxy Grout, ANSI A118.7 for joints 1/8 inch to 1/2 inch.
 - b. Acceptable Products: Laticrete International PermaColor Grout or MAPEI Ultracolor Plus Grout.
- D. Silicone Sealant: 100% Silicone Caulk by Custom Building Products or equal; color as indicated in drawings.
- E. Tile and Grout Sealer: Aqua Mix, Inc., Santa Fe Springs, CA
- F. Reinforcing provide according to manufacturer requirements:
 - 1. Mesh: 2 by 2 inch (50 by 50 mm) size weave of 16/16 wire size; welded fabric,

galvanized.

- 2. Metal Lath: ÅSTM C847, Flat expanded diamond mesh, not less than 2.5 lbs/SY, galvanized finish.
- G. Cementitious Backer Board: Refer to Section 09 29 00 for Cement Backer Board.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are free of substances which would impair bonding of setting materials, smooth and flat within tolerances specified in ANSI A137.1, and are ready to receive tile.
- B. Verify that sub-floor surfaces are dust-free, and free of substances which would impair bonding of setting materials to sub-floor surfaces, and are smooth and flat within tolerances specified in ANSI A137.1.
- C. Verify that required floor-mounted utilities are in correct location.
- D. According to Section 07 05 00, verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- E. Report any conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the conditions. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.02 PREPARATION

A. General

- 1. Coordinate work with other trades as needed to assure that proper substrate are provided to receive work of this Section.
- 2. Before tiling, confirm variations of surface to be tiled fall within maximum variations shown below:
 - a. Cement Mortar Bed: 1/4" in 8' for walls, 1/4" in 10' for floors.
 - b. Epoxy Adhesive: 1/8" in 8' for walls, 1/8" in 10' for floors.
 - c. Organic Adhesive: 1/8" in 8' for walls, 1/8" in 8' for floors
- 3. Surfaces shall be clean and free of dust, oil, grease, paint, tar, wax, curing compound, primer, sealer, form release agent, laitance, loosely bonded topping, loose particles or any deleterious substance and debris which may prevent or reduce adhesion.
- 4. Patch any deep abrasions to the existing mortar bed substrate prior to skim coating and installing the new crack isolation membrane
- B. Concrete Surface Preparation
 - 1. All concrete substrates shall be at least 28 days old, completely cured and free of hydrostatic conditions, and/or moisture problems.
 - 2. New concrete surfaces for dry-set mortar, medium-bed mortar or thick-bed mortar installations shall be wood floated or broom finished. Concrete walls should be bush-hammered or heavily sandblasted. On grade or below grade concrete slabs must be installed over an effective vapor barrier and be exempt from hydrostatic

pressures.

- 3. Over excessively dry porous concrete, keep the concrete substrate continuously moist for at least 24 hours before work begins when using dry-set mortars or medium-bed mortars. Remove all excess water or standing water allowing the surface to become almost dry before installing the leveling coat, dry-set mortar or medium-bed dry-set mortar.
- 4. For minor repairs and smoothing up to 1/2 inch (12 mm), use Skim Coat & Patch Cement Underlayment or Speed Finish Patching & Finishing Compound.
- 5. For leveling of large areas use LevelLite Self-Leveling Underlayment for pours up to 2 inches (51 mm) thick, LevelQuik Rapid Setting Self-Leveling Underlayment for pours up to 1 inch (25 mm) thick or Extended Setting Self-Leveling Underlayment for pours up to 1 inch (25 mm) thick.
- 6. Custom Float Bedding Mortar mixed with water and Acrylic Mortar Admix to build-up or level a concrete substrate requiring a topping between 1/2 inch (12 mm) and 2 inch (50 mm) average thickness (see data sheet for details).

3.03 INSTALLATION – GENERAL

- A. Comply with current TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Except as otherwise may be specified herein, all tile work shall conform with Standard Specifications A-108.1, A-108.4, A-108.5, A-108.6, A-108.9, A-108.10 issued by the American National Standards Institute.
- C. All tile shall be cut for proper fitting around work in place. Exposed edges of cuts shall be rubbed smooth with an abrasive stone. All tile shall be ground and carefully fitted at intersections against trim finish between fixtures and accessories. Tile shall be carefully fitted around outlets, pipes, fixtures, and fittings so that the plates, escutcheons, or collars all overlap the cut.
- D. Tile shall be kept free of stains before placing. Temporary guide strips shall be set with mortar or spot tiles shall be placed to fit the exact plans of each finish wall line. Mortar bed for interior glazed wall tile shall be not less than 3/8" thick and not more than 1/2" thick.
- E. Pattern of tile shall be accurately laid out and established working from center of each wall or space to assure equal size tiles on ends. Patterns shall be as noted on the drawings.
- F. All joints shall be grouted full, flush and smooth with the specified grout in accordance with the manufacturer's instructions.
- G. All walls shall be checked for plumb and all angles checked for square before tile work is started.

3.04 LIQUID MEMBRANE INSTALLATION

- A. Pre-treat Penetrations: Pack any gaps around pipes, lights or other penetrations with a compressible backer rod and suitable waterproof sealant. Apply a liberal coat of liquid around penetration opening. Embed pieces of 6" (15 cm) wide fabric into liquid. Cover with a second layer of liquid. After curing, seal flashing with a waterproof sealant.
- B. Expansion Joints: Cracks in excess of 1/8" (3 mm) should be treated as expansion joints. Carry these types of joints through any subsequent finishing material. Clean the joint and install open or closed cell backer rod to the proper depth as outlined in EJ 171 in the Tile Council Handbook. Next, compress a sealant as specified by the architect into the joint, coating the sides and leaving it flush with the surface. After the sealant is dry, place bond breaker tape over

joint. Apply a minimum 3/64" (1.2 mm) of liquid over the joint and substrate. Install the tile work onto the membrane but do not bridge the joint. After the tile work is set properly, fill the joint with any specified color sealant, following the architect's and manufacturer's instructions.

- C. Pre-treat Drains:
 - 1. Drains should have a clamping ring with open weep holes for thin-set application. Cut a square of reinforcing fabric approximately 38" x 38" (96 x 96 cm). In the center of the fabric cut a hole that matches the diameter of the drain throat. Apply a liberal coat of liquid to the bottom flange. Drain should be fully supported without movement and even with plane of substrate.
 - 2. Center the circular cutout over the drain throat and embed the fabric into the liquid making sure it does not obstruct the drainage hole. Then apply an additional coat of liquid. Wet coat thickness should be 20 30 mils thick.
 - 3. After curing, apply a waterproof sealant bead where the fabric cutout meets the drain throat. Clamp upper flange onto membrane and tighten. Caulk with a silicone caulk around flange where membrane and upper flange make contact. A toilet flange can be handled in much the same manner.

3.05 SETTING MATERIALS INSTALLATION

- A. Specified medium bed setting materials may be installed up to 3/4 of an inch thick on horizontal surfaces.
- B. Apply mortar or adhesive with notched trowel using scraping motion to work material into good contact with the wall surface to be covered. Maintain 95 percent coverage on back of Tile and fully bed all corners.
- C. When installing natural stone Tiles, trowel a sufficient quantity of mortar adhesive onto back of each Tile.
- D. Maintain 95 percent coverage on back of the Tile and fully bed all corners.
- E. Apply only as much mortar or adhesive as can be covered within allowable windows as recommended by mortar or adhesive manufacturer or while surface is still tacky.
- F. Set Tiles in place and rub or beat with small beating block.
- G. Lightly beat or rap Tile to ensure proper bond and also to level surface of Tile.
- H. The setting materials must be free of voids to create a continuous, solid bond.
- I. Align Tile to show uniform joints and allow for setting until firm.
- J. Clean excess mortar or adhesive from surface of Tile with wet cheesecloth while mortar is fresh.

3.06 GROUT INSTALLATION

- A. Allow tile to set for a minimum of 48 hours prior to grouting. Remove all spacers, ropes, glue and foreign material prior to grouting.
- B. Follow grout manufacturer's recommendations as to grouting procedures and precautions.
 - 1. Force maximum amount of grout into joints in accordance with pertinent recommendations in ANSI 108.10.
 - 2. Fill-joints of cushion edged tile to depth of cushion; fill square edged tile flush with surface.
 - 3. Provide hard finished grout which is smooth and without voids, pinholes or low spots.
 - 4. Seal grout with specified penetrating sealer 48-72 hours after grout application.

3.07 JOINT INSTALLATION

- A. Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
- B. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- C. Joints must be carried through all layers of installation materials including tile, setting bed, mortar bed and reinforcing wire. Joints should be every 20 to 25 feet in both directions for interior installations and 8 to 12 feet in both directions for exterior installations. (Refer to TCA Handbook, EJ171 and ANSI AN-3.8 for details on placements, size and specifications of materials).

3.08 INSTALLATION - FLOORS - MORTAR BED METHODS

- A. Over interior concrete substrates, install in accordance with TCA Handbook Method F111, with cleavage membrane, unless otherwise indicated.
 - 1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCA Handbook Method F121.
 - 2. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F132, bonded.
 - 3. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCA Handbook Method F114, with cleavage membrane.
- B. Cleavage Membrane: Lap edges and ends.
- C. Waterproofing Membrane: Install as specified in ANSI A108.13.
- D. Mortar Bed Thickness: 1-1/4 to 2 inch (32 to 51 mm) maximum, unless otherwise indicated.

3.09 INSTALLATION - SHOWERS

- A. At tiled shower receptors install in accordance with TCA Handbook Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.
- B. Grout with standard grout as specified above.
- C. Seal joints between tile work and other work with sealant specified in Section 07900.

3.10 INSTALLATION - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCA Handbook Method W244, using membrane at toilet rooms.
- B. Over gypsum wallboard on wood or metal studs install in accordance with TCA Handbook Method W243, thin-set with dry-set or latex-portland cement bond coat, unless otherwise indicated.
- C. Over wood studs without backer install in accordance with TCA Handbook Method W231, mortar bed, with membrane where indicated.
- D. Over metal studs without backer install in accordance with TCA Handbook Method W241, mortar bed, with membrane where indicated.

3.11 <u>CLEANING</u>

Clean and seal all tile and grout surfaces.

3.12 PROTECTION OF FINISHED WORK

- A. Do not permit traffic over finished floor surface for 72 hours after installation.
- B. Cover floors with kraft paper and protect from dirt and residue from other trades.

C. Where floor will be exposed for prolonged periods cover with plywood or other similar type walkways

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Acoustical Ceiling Work, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

- A. Have applicators approved by manufacturer of material or system being installed.
- B. Work hereunder requires coordination with trades who's Work connects with, is affected, or concealed by acoustical units. Before proceeding with Work, make certain all required inspections have been made.
- C. Examine sub-surfaces to receive Work. Commencement of Work will be construed as acceptance of all sub-surfaces.
- D. Comply with all applicable requirements of Acoustical Materials Association, Bulletin "Architectural Acoustical Materials".

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Submit complete layout of all systems including attachments, intersections of members and edge conditions.
- D. Samples: submit 2 samples of each type of unit specified herein.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

C. Deliver all manufactured materials in original containers bearing manufacturer's name and brand. Use only one brand for each type of unit throughout job. Store materials within building in locations directed.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 SUSPENSION GRID

- A. Ceiling Suspension Materials: Comply with ASTM C635, as applicable to the type of suspension system required for the type of ceiling units indicated. Coordinate with other work supported by or penetrating through the ceilings.
- B. Manufacturer, Type, Location, and Pattern: as indicated on the drawings.
- C. Edge Mouldings: Manufacturer's standard channel moulding for edges and penetrations of ceiling, with a single flange of moulding exposed, white baked enamel finish, unless otherwise indicated.

2.02 ACOUSTICAL TILE

- A. Manufacturer, Type, Location, and Pattern: as indicated on the drawings.
- B. Substitutions: As approved by Architect.

2.03 EXTRA STOCK

Order additional 3% of each type, with one box minimum, of acoustical unit specified, for maintenance use, at no additional cost to Owner.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Installer must examine the conditions under which the acoustical ceiling work is to be performed and notify the Contractor in writing of any unsatisfactory conditions. This installer shall make sure all unsatisfactory conditions have been corrected in a manner acceptable to the installer before proceeding with Work.
- B. Provide all materials and accessories for complete installation per Drawings and manufacturer's printed instructions and recommendations.
- C. Install units to sub-surfaces from setout points and to pattern shown on Drawings. Verify location of Work of other trades so their items occur within a whole unit or at joints as shown.
- D. Install units in place fitting snugly. Provide spacers or hold-down clips where shown or required.
- E. After installation, clean any soiled surfaces. Replace any damaged units at no additional cost to the Owner.
- F. Arrange acoustical units in the manner shown by reflected ceiling plans. Consult with Architect pertaining to any adjustments.

3.02 SUPPORT SYSTEMS FOR SUSPENDED CEILING

- A. General: Ceilings shall not support material or building components other than grills, insulation batts or light fixtures. Duct work, plumbing and like work shall have its own support system and shall not use the ceiling system or suspension wires.
- B. Vertical Support System: Suspension wires shall be a minimum of 12-gauge galvanized wire attached to the main runner at 4 ft. maximum spacing in both directions. Each wire shall be anchored to the structure above with a device capable of supporting a minimum of 75 pounds. Wires supporting fixtures shall be capable of supporting four times the fixture weight. Suspension wires shall not hang more than 1 in 6 out of plumb unless counter sloping wires are provided. Wires shall not attach to or bond around interfering material such as ductwork. Trapeze or equivalent devices shall be used where obstructions interfere with direct suspension.
- C. Horizontal Support System: The lateral support system for ceilings shall be shown in detail shop Drawings. Provisions shall be made for possible deferential movement between ceilings and sidewalls. Terminal ends of each main and each cross runner shall be wire supported; wall trim angles shall not provide primary support for runners. Lateral support of ceilings shall not be provided by the angle trim and runner shall not be riveted to wall trim.
- D. Light Fixture Support: All recessed or drop-in light fixtures shall be supported directly from the fixture housing to the structure above with a minimum of two 12 gauge wires; leveling and positioning of fixture may be provided by the ceiling grid. Fixture support wires may be slightly loose to allow fixture to seat in heavy-duty grid system only.
- E. Secure wire hangers by looping and wire tying either directly to structures or to inserts, eyescrews or other devices which are secure and appropriate for the substrate, and which will not deteriorate or fail with age or elevated temperatures.

3.03 CLEANING AND PROTECTION

- A. Clean exposed surfaces of acoustical ceilings, including trim, edge mouldings and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
- B. The installer shall advise the Contractor of required protection for the acoustical ceilings,

including temperature and humidity limitations and dust control, so that the Work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION

SECTION 09 61 19

CONCRETE FLOOR STAINING

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Section includes:
 - 1. Chemically stained concrete floor finish.
 - 2. Sealer.
- B. Related Sections:
 - 1. Section 03 30 00 "Cast-In-Place Concrete" for general concrete applications.

1.03 STANDARDS AND REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C 171: Standard Specification for Sheet Materials for Curing Concrete.
 - 2. ASTM C 309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 3. ASTM F 1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 10 years of documented experience producing the specified products.
- B. Installer Qualifications: Minimum 5 years of documented experience with work of similar scope and complexity required by this Project and acceptable to, or certified by, concrete stain manufacturer.
- C. Regulatory Requirements:
 - 1. Products to comply with United States Clean Air Act for maximum Volatile Organic compound (VOC) content as specified in this Section.
- D. Material Source: Obtain each specified material from the same source.
- E. Notification: Give a minimum 7 calendar days' notice to manufacturer's authorized field representative before date established for commencement of concrete stain work.
- F. Concrete Stain Mockups:
 - 1. Construct a 4 foot by 4 foot mockup at location selected by Architect.
 - 2. Provide individual mockups for each color and pattern required.
 - 3. Construct mockup using materials, processes, and techniques required for the work, including curing procedures. Incorporate representative control, construction, and expansion joints according to Project requirements. Installer for the work to construct mockup.

- 4. Mockup to be stained and sealed by the Installer who will actually perform the work for the Project. Record the amount of chemical stain needed per square foot of application to establish coverage rates for the work.
- 5. Notify Architect and Owner a minimum of seven calendar days in advance of the date scheduled for each mockup construction.
- 6. Obtain the Architect's and Owner's acceptance of each mockup prior to commencement of the work.
- 7. Each mockup to remain until completion of the work to serve as a quality control standard for the work. Provide suitable protections to preclude damage to mockup.
- 8. Demolish and remove each mockup from site when directed.
- G. Pre-Installation Conference
 - 1. Seven calendar days prior to scheduled date of installation, conduct a meeting at Project site to discuss requirements, including application methods. Attendees to include Architect, Owner, Contractor, Installer, and manufacturer's authorized field representative.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Product Data: Manufacturer's technical data, including Safety Data Sheet (SDS) and installation instructions, for each product specified.
- D. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available.
- E. Qualification Data: For manufacturer and Installer.
- 1.07 DELIVERY, STORAGE, AND HANDLING
 - A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
 - B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
 - C. Deliver products in original factory unopened, undamaged packaging bearing identification of product, manufacturer, batch number, and expiration date as applicable.
 - D. Store products in a location protected from damage, construction activity, and adverse environmental conditions, and away from combustible materials and sources of heat, according to manufacturer's printed instructions and current recommendations.
 - E. Handle products according to manufacturer's printed instructions.

1.08 PROJECT CONDITIONS

A. Environmental Conditions: Maintain an ambient temperature between 50 deg F and 90 deg F during application and at least 48 hours after application.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.010 EXTRA MATERIALS

Not required.

1.011 RECORD DRAWINGS

Not required.

1.012 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 <u>MANUFACTURERS</u>

- A. Basis of Design: Provide products specified herein manufactured Scofield, a Sika Corporation.
- B. Or Architect approved equal.

2.02 MATERIALS

- A. Reactive Chemical Concrete Stain: Reactive, water-based solution of metallic salts which react with calcium hydroxide in cured concrete substrates to produce permanent variegated or translucent color effects. Zero VOC content.
 - 1. Product: LITHOCHROME Chemstain Classic
 - 2. Color: As indicated in the Drawings.
- B. Sealing Compound
 - 1. Scofield Repello FPS Water and Stain Repellant

PART 3 - EXECUTION

- 3.01 EXAMINATION
 - A. Examine areas and conditions under which the concrete stain work will be performed and identify conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. New Concrete: Comply with the following:

- 1. Newly placed concrete to sufficiently cure for concrete to become reactive. Minimum cure time is 14 days.
- B. Surface Preparation for New or Existing Concrete:
 - 1. Concrete surfaces should be completely penetrable before applying the initial application of chemical stain. The surface of the concrete should be lightly mechanically abraded to remove weak cement paste and contaminants. The final surface preparation should approximate a Concrete Surface Profile of 1, (CSP1 as designated by the International Concrete Repair Institute, Alexandria, Virginia). Methods for mechanical abrasion include:
 - a. Pressure Washing: Use a pressure washer equipped with a fan tip and rated for a minimum pressure capability of 4000 psi.
 - b. Scrubbing with a rotary floor machine with a Mal-Grit Brush from the Malish Corporation.
 - c. Light sanding of the surface.

Surfaces should be tested to receive stain by spotting with water. Water should immediately darken the substrate and be readily absorbed. If water beads and does not penetrate or only penetrates in some areas, perform additional surface preparation and testing. On denser concrete floors, sand lightly to open up surfaces. Retest and continue surface preparation until water spots immediately darken and uniformly penetrate concrete surfaces.

2. Rinse concrete substrates until rinse water is completely clean.

3.03 CHEMICAL STAIN APPLICATION

- A. General: Comply with chemical stain manufacturer's printed instructions and current recommendations.
 - 1. Do not mix the specified chemical stain with highly alkaline materials. Doing so will result in a dangerous chemical reaction.
- B. Protect surrounding areas, landscaping, and adjacent surfaces from overspray, runoff, and tracking. Divide surfaces into small work sections using walls, joint lines, or other stationary breaks as natural stopping points.
- C. Apply chemical stains at the coverage rate recommended by the manufacturer and use application equipment according to the chemical stain manufacturer's printed instructions. Note the color of the liquid chemical stain will not be the final color produced on the concrete substrate.
- D. Transfer chemical stain to the substrate by brush or spray and immediate scrub into surface. Reaction time depends on wind conditions, temperatures, and humidity levels.
- E. When multiple coats of one or more colors are required, washing and drying between colors is desirable to evaluate the color prior to the next coat.
- F. Rinsing: After the final coat of chemical stain has remained on the surface for a minimum of four hours, neutralize unreacted chemical stain residue and then remove completely prior to sealing. After neutralization, thoroughly rinse surface with clean water several times to remove soluble salts. While rinsing, lightly abrade surface using a low-speed floor machine and red pad to remove residue and weakened surface material. Runoff may stain the adjacent areas or harm plants. Collect rinse water by wet vacuuming or absorbing with an inert material.
 - 1. Failure to completely remove all residue prior to sealing the surface will cause appearance defects, adhesion loss or peeling, reduced durability, and possible bonding failure and delamination of sealer.
2. All stain residue, runoff liquid, and rinse water must be collected and disposed of according to applicable Federal regulations and governing authorities having jurisdiction.

3.04 SEALING APPLICATION

- A. Concrete substrate must be completely dry. Test surface for proper pH prior to applying sealer. A pH value of 7 or higher indicates all acid has been neutralized. If the tested pH value is less than 7, repeat neutralization step until the required pH value is achieved.
- B. Conduct a moisture vapor emission test prior to applying any sealer. Refer to the specific sealer's Technical-Data Bulletin for acceptable MVER.
- C. Apply sealer according the sealer manufacturer's printed instructions at a rate of 300 to 500 square feet per gallon per coat. Maintain a wet edge at all times.
- D. Allow sealer to completely dry before applying additional coats.
- E. Apply second coat of sealer at 90 degrees to the direction of the first coat using the same application method and rates.
- F. Seal horizontal joints in areas subject to pedestrian or vehicular traffic.

3.05 PROTECTION

- A. The General Contractor is responsible for using Temporary Floor Protection throughout the project to safeguard the surface quality of concrete slabs before and after application of decorative finishes or installations of other materials.
- B. All concrete floors that will be not be covered by other materials will be protected throughout the project. The concrete slab must be treated as a finished floor at all times during construction.
- C. Temporary Floor Protection will be removed only while finish work to the concrete is being performed and will be replaced after the final finish has cured sufficiently.
- D. Temporary Floor Protection will be SCOFIELD Proguard Duracover, manufactured by Sika Corporation. Seaming of the temporary floor protection will be performed with SCOFIELD Proguard Heavy Duty Seaming Tape. Both products will be installed following the manufacturer's published installation procedures.
- E. DO NOT APPLY THE HEAVY DUTY SEAMING TAPE TO BARE OR FINISHED FLOORS OR WALL SURFACES AT ANY TIME. IT WILL PERMANENTLY DAMAGE THE FLOOR

3.06 MAINTENANCE

A. Maintain chemically stained and sealed floors by sweeping. Clean spills when they occur and rinse dirt off with water. Wet-clean heavily soiled areas by mopping or by scrubbing with a rotary floor machine equipped with a scrubbing brush and a suitable, high quality commercial detergent. Maintain interior floors that require polishing by using a compatible, premium-grade, emulsion-type, commercial floor polish, according to manufacturer's printed instructions and safety requirements.

END OF SECTION

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SECTION 09 65 00

RESILIENT FLOORING AND BASE

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all Resilient Flooring and Base, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section Includes:
 - 1. Resilient flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.
- C. Related Sections:
 - 1. Division 3 Concrete; not the work of this section
 - 2. Division 6 Wood and Plastics; not the work of this section
 - 3. Division 7 Thermal and Moisture Protection; not the work of this section
 - 4. Other Division 9 sections for floor finishes related to this section but not the work of this section

1.03 STANDARDS AND REFERENCES

- A. Armstrong Flooring Technical Manuals
 - 1. Armstrong Flooring Guaranteed Installation Systems manual, F-5061
 - 2. Armstrong Flooring Maintenance Recommendations and Procedures, manual, F-8663
- B. ASTM International:
 - 1. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
 - 2. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
 - 3. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - 4. ASTM F 1303 Standard Specification for Sheet Vinyl Floor Covering with Backing
 - 5. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
 - 6. ASTM F 1861 Standard Specification for Resilient Wall Base
 - 7. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - 8. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

- C. National Fire Protection Association (NFPA):
 - 1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
 - 2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials

1.04 QUALITY ASSURANCE

- A. Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including moisture mitigation systems, primers, leveling and patching compounds, and adhesives.
- B. Select an installer who is experienced and competent in the installation of Armstrong resilient sheet flooring using heat-welded seams.
 - 1. Engage installers certified as Armstrong Commercial Flooring Certified Installers
 - 2. Confirm installer's certification by requesting their credentials
- C. Fire Performance Characteristics: Provide resilient vinyl sheet flooring with the following fire performance characteristics as determined by testing material in accordance with ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:
 - 1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I
 - 2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less
 - 3. CAN/ULC-S102.2 Flame Spread Rating and Smoke Developed Results as tested

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions (latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061. for flooring and accessories.
- D. Submit the manufacturer's standard samples showing the required colors for flooring, welding rods, and applicable accessories.
- E. Submit Safety Data Sheets (SDS) available for adhesives, moisture mitigation systems, primers, patching/leveling compounds, floor finishes (polishes) and cleaning agents and Material Information Sheets for flooring products.
- F. If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B -

Services, Materials and Equipment.

- C. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- D. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- E. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.08 PROJECT CONDITIONS

A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65°F (18°C) and a maximum temperature of 85°F (29°C) for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55°F (13°C) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances. Refer to the Armstrong Flooring Guaranteed Installations Systems manual, F-5061 for a complete guide on project conditions.

1.09 OPERATION AND MAINTENANCE DATA

- A. Provide in accordance with Project Manual Volume One, Article 6.12 Record Documents.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Provide in accordance with Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- D. Include manufacturer's recommended methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.10 EXTRA MATERIALS

- A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.
- B. Extra Materials: Deliver extra materials to Owner. Furnish extra materials from same production run as products installed. Packaged with protective covering for storage and identified with appropriate labels.
 - 1. Provide 5% of each pattern and color of flooring and of base specified.
 - 2. Comply with Owner's requirements for delivery, storage and protection of extra material.

1.11 <u>RECORD DRAWINGS</u>

Not required.

1.12 WARRANTY

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Limited Manufacturer's Warranty

- 1. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.
- 2. Limited Warranty Period: 5 years
- 3. The Limited Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.
- 4. For the Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.
- E. Manufacturer's Extended System Limited Warranty
 - 1. Resilient Flooring System: Submit a written warranty executed by the manufacturer, agreeing to repair or replace system (subfloor preparation products, adhesive, and floor covering) that fails within the warranty period.
 - 2. Limited Warranty Period: 10 years on top of the Resilient Flooring Limited Warranty
 - [S-453 Level Strong[™] cement based self-leveling compound] [S-456 Patch Strong[™] flexible patching and smoothing compound] [S-454 Prime Strong[™] acrylic primer for porous substrates] [S-455 Prime Strong[™] acrylic primer for non-porous substrates] [S-452 Seal Strong[™] two part moisture mitigation system]
 - 4. The installation of an Armstrong Flooring product along with the recommended Armstrong Flooring adhesive, as well as any one of the Strong System subfloor preparation products listed above, provides 10 additional years of limited warranty coverage. The Strong System limited warranty covers the installation integrity for the length of the flooring product warranty plus 10 years. In order to qualify for the Strong System Warranty, any subfloor preparation product needed for an installation must be an Armstrong Flooring product.
 - 5. For the System Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.
 - 6. When Armstrong Flooring Strong System subfloor preparation products are used with other manufacturers' floor coverings, adhesives, or other subfloor preparation products, Armstrong Flooring warrants our products to be free from manufacturing defects from the date of purchase through the limited warranty period of 15 years.

1.13 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide flooring which has been manufactured, fabricated and installed to performance criteria certified by manufacturer without defects, damage, or failure.
- B. Administrative Requirements
 - 1. Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.
 - 2. Pre-installation Testing: Conduct pre-installation testing as follows: [Specify testing (i.e. moisture tests, bond test, pH test, etc)
- C. Mock-ups: Install at the project site a job mock-up using acceptable products and manufacturer approved installation methods, including concrete substrate testing. Obtain

Owner's and Consultant's acceptance of finish color, texture and pattern, and workmanship standards.

- 1. Mock-Up Size: 4 feet by 4 feet square.
- 2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
- 3. Incorporation: Mock-up may be incorporated into the final construction with Owner's approval.
- D. Sequencing and Scheduling
 - 1. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.
 - 2. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond, moisture tests and pH test.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Basis of Design: Armstrong Flooring Inc., 2500 Columbia Avenue, Lancaster, PA 17603, www.armstrongflooring.com/commercial.

2.02 RESILIENT SHEET FLOORING MATERIALS

- A. Slip-retardant Resilient Sheet Flooring:
 - 1. Basis of Design: Safety Zone Sheet as manufactured by Armstrong Flooring Inc.
 - 2. Description: A layered construction consisting of an embossed, slip-retardant wear layer with mineral aggregates on saturated glass fiber backing. Mineral aggregates are dispersed uniformly throughout the thickness of the wear layer. Colors are insoluble in water and resistant to cleaning agents and light.
 - 3. Heterogeneous slip retardant sheet flooring shall conform to the requirements of ASTM F1303 Standard Specification for Sheet Vinyl Floor Covering with Backing, Type II, Grade 1, with Class A backing
 - 4. Pattern and Color: as indicated in the Drawings
 - 5. Width: 6 ft. 7 in. (2.0 m)
 - 6. Length: up to 66 lineal feet (20 meters)
 - 7. Thickness: 0.080 in. (2.0 mm)
 - 8. Provide integral flash cove wall base by extending sheet flooring 6 in. (15.24 cm) up the wall using adhesive, welding rod, and accessories recommended and approved by the flooring manufacturer.
- B. Decorative Heterogeneous Sheet Flooring:
 - 1. Basis of Design: DecorArt Rejuvenations TimberLine Heterogeneous Sheet Flooring with Diamond 10 Technology coating as manufactured by Armstrong Flooring Inc.
 - 2. Description: A multi-layered construction consisting of a clear vinyl wear layer and a printed, reinforced fiberglass inner layer on a solid vinyl backing. Protected by a UV-cured, high performance diamond-infused polyurethane finish, the wear surface has an overall embossed texture. Colors are insoluble in water and resistant to cleaning agents and light.

- Heterogeneous sheet flooring shall conform to the requirements of ASTM F1303 Standard Specification for Sheet Vinyl Floor Covering with Backing, Type I, Grade 1, with Class B backing
- 4. Pattern and Color: as indicated in the Drawings
- 5. Width: 6 ft. 7 in. (2.0 m).
- 6. Length: up to 82 lineal feet (25 meters)
- 7. Thickness: 0.080 in. (2.0 mm)
- 8. Wear layer thickness : 0.022 in. (0.55 mm)
- 9. Provide Armstrong Flooring S-761 seam adhesive at seams as recommended by manufacturer.
- C. Vinyl Weld Rod:
 - 1. Provide solid color vinyl weld rod and intended for heat welding of seams. Color shall be compatible with field color of flooring as selected by Architect from the range currently available from manufacturer's standard colors.

2.03 STATIC DISSIPATIVE TILE

- A. Static Dissipative Tile
 - 1. Basis of Design: SDT Static Dissipative Tile Flooring as manufactured by Armstrong Flooring Inc.
 - 2. Description: Static dissipative vinyl tile composed of polyvinyl chloride resin, plasticizers, fillers, pigments, and antistatic additive with colors and texture dispersed uniformly throughout its thickness.
 - 3. Tile shall meet size, thickness, indentation, impact, deflection, dimensional stability, resistance to chemicals, squareness, and resistance to heat requirements of ASTM F 1066 Standard Specification for Vinyl Composition Tile, Class 2, through pattern.
 - 4. Pattern and Color: as indicated in the Drawings
 - 5. Size: 12 in. x 12 in.
 - 6. Thickness: 1/8"/0.125 in. (3.2mm)

2.04 WALL BASE MATERIALS

A. For top set wall base: Provide 6 in. (15.24 cm) high Armstrong Flooring Color-Integrated Wall Base with a matte finish, conforming to ASTM F 1861, Type TV - Vinyl, Thermoplastic, Group 1 - Solid, Style B – Cove.

2.05 <u>ADHESIVES</u>

A. For Resilient Sheet Flooring:

- 1. Provide, for Standard Installation, Armstrong S-599 Vinyl Sheet Flooring Adhesive Premium Commercial for field areas and Armstrong S-580 Flash Cove Adhesive at flash coving as recommended by the flooring manufacturer.
- 2. Provide, for High-Moisture Installation Warranty, Full Spread, Armstrong S-543 Commercial Sheet Flooring for field areas and Armstrong S-580 Flash Cove Adhesive at flash coving as recommended by the flooring manufacturer.
- B. For Static Dissipative Tile:
 - 1. Provide Armstrong S-202 Static Dissipative Tile Adhesive with 2 in. (5.08 cm) wide x 24 in. (60.96 cm) long copper ground-connection strips for under the tile.
- C. For Wall Base:

1. Provide S-725 Wall Base Adhesive at the wall base.

2.06 <u>ACCESSORIES</u>

- A. For patching, smoothing, and leveling monolithic subfloors (concrete, terrazzo, quarry tile, ceramic tile, and certain metals), provide Armstrong S-184 Fast-Setting Cement-Based Patch and Underlayment.
- B. For priming porous substrates to aid in adhesive bond strength and reducing subfloor porosity, provide S-454 Prime Strong[™] acrylic primer for porous substrates. For non-porous substrates, provide S-455 Prime Strong[™] acrylic primer for non-porous substrates.
- C. For creating a moisture barrier, provide S-452 Seal Strong[™] two part moisture mitigation system.
- D. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.
- E. Provide top edge trim caps for integral flash cove as approved by the Architect.
- F. Provide a fillet support strip for integral cove base with a minimum radius of 1 in. (2.54 cm) of wood or plastic.
- G. Provide transition/reducing strips tapered to meet abutting materials.
- H. Provide threshold of thickness and width as shown on the drawings.
- I. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.
- J. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.
- K. Provide Armstrong S-392 Static Dissipative Tile Polish for application as initial and on-going static dissipative maintenance finish.

PART 3 – EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

Comply with manufacturer's product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions (i.e. moisture tests, bond test, pH test, etc.).
- B. Visually inspect flooring materials, adhesives and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.
- C. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

- D. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
- E. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.03 PREPARATION

- A. Subfloor Preparation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with Armstrong Flooring S-184 Fast-Setting Cement-Based Patch and Underlayment.
- B. Subfloor Preparation Moisture Mitigation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, mitigate moisture and other defects with Armstrong Flooring S-454 Prime Strong[™] acrylic primer for porous substrates.
- C. Subfloor Cleaning: The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, sealers, release agents, curing compounds, residual adhesive, adhesive removers and other foreign materials that might affect the adhesion of resilient flooring to the concrete or cause a discoloration of the flooring from below. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these contaminants are present on the substrate they must be mechanically removed prior to the installation of the flooring material. Refer to the <u>Armstrong Flooring Guaranteed Installation Systems</u> manual, F-5061 and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.
- D. Moisture Testing: [When using S-599 Adhesive, perform subfloor moisture testing in accordance with [ASTM F 2170, Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes][ASTM F 1869,Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride] and Bond Tests as described in publication F-5061 <u>Flooring Guaranteed Installation Systems</u>, manual, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. [Internal relative humidity of the concrete shall not exceed 90%.][MVER shall not exceed 5 lbs./1000 sq. ft./24 hrs.] On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained]
- E. Moisture Testing: For High-Moisture Installation Warranty when using Armstrong Flooring S-543 Adhesive), perform subfloor moisture testing in accordance with [ASTM F 2170, Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes][ASTM F 1869,Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride] and Bond Tests as described in publication F-5061, <u>Armstrong Flooring Guaranteed Installation Systems</u>, manual, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. [Internal relative humidity of the concrete shall not exceed 90%.][MVER shall not exceed 5 lbs./1000 sq. ft./24 hrs.] On installations where

both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained].

F. Concrete pH Testing: Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.

3.04 INSTALLATION OF FLOORING

- A. Install flooring in strict accordance with the manufacturer's latest edition of the installation manual.
- B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
- D. Scribe, cut, and fit or flash cove to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- E. Adhere flooring to the subfloor without cracks, voids, raising and puckering at the seams. Roll with a 100-pound (45.36 kilogram) roller in the field areas. Hand-roll flooring at the perimeter and the seams to assure adhesion. Refer to specific rolling instructions of the flooring manufacturer.
- F. Lay flooring to provide a minimum number of seams. Avoid cross seams, filler pieces, and strips. Match edges for color shading and pattern at the seams in compliance with the manufacturer's recommendations.
- G. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.
- H. Prepare heat-welded seams with special routing tool supplied for this purpose and heat weld with vinyl welding rod in seams. Use methods and sequence of work in conformance with written instructions of the flooring manufacturer. Finish all seams flush and free from voids, recesses, and raised areas.
- I. Provide integral flash cove wall base where shown on the drawings, including cove fillet support strip and top edge cap trim. Construct flash cove base in accordance with the flooring manufacturer's instructions. Heat-weld seams as specified for those on the floor.

3.05 INSTALLATION OF ACCESSORIES

- A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.
- B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.
- C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.
- D. Apply butt-type metal edge strips where shown on the drawings, before flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

3.06 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.

3.07 <u>CLEANING</u>

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Perform initial and on-going maintenance according to the manufacturer's instructions.

END OF SECTION

SECTION 09 68 00

CARPETING

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Furnish all Materials and perform labor required to execute this work as indicated on the drawings, as specified and as necessary to comply with the Contract Documents, including, but not limited to, these major items:

- A. Direct glue down carpet with backing.
- B. Metal edge trim and backing for carpet coved wall base if indicated on the drawings.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Submit the following:
 - 1. Product data on specified products, describing physical and performance characteristics: sizes, patterns, colors available, and method of installation.
 - 2. Samples illustrating color and pattern for each carpet material specified if substituting from color board.
 - 3. Manufacturer's installation instructions. When approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on this Work.
 - 4. Acceptance of conditions of testing of Flooring Substrate for requirements prior to installation according to Section 07 05 00.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

1.08 PROJECT CONDITIONS

- A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- B. Maintain minimum 72 degrees F ambient temperature plus/minus 5 degrees with relative humidity not exceeding 65% three days prior to, during, and 72 hours after installation of materials.

1.09 OPERATION AND MAINTENANCE DATA

- A. Provide in accordance with Project Manual Volume One, Article 6.12 Record Documents.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Provide in accordance with Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- D. Submit operation and maintenance data maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning and shampooing.

1.10 EXTRA MATERIALS

- A. Provide in accordance with Project Manual Volume Four, Section 01 78 00.
- B. Provide an extra 5% of carpeting of each color specified.

1.11 RECORD DRAWINGS

Not required.

1.12 WARRANTY

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Provide Manufacturer's Lifetime Commercial Limited Warranty.

PART 2 – PRODUCTS

2.01 <u>CARPET</u>

Manufacturer(s), Type(s), Location(s), Pattern(s), and Color(s) as indicated on drawings.

2.02 FLOORING TRANSITIONS

Manufacturer(s), Type(s), Location(s), Finishes(s), as indicated on drawings.

2.03 OTHER ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by carpet manufacturer.

B. Primers and Adhesives: Waterproof; of types recommended by carpet manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the Work.
- C. Verify that substrate surfaces are smooth and flat with maximum variation of 1/8 inch in 10 ft. and are ready to receive work. Have all previous adhesives removed.
- D. Concrete Slab Testing:
 - 1. <u>Alkalinity</u>: Test the concrete for alkalinity prior to beginning the installation. Check the concrete for surface pH at several locations. A reading below 5.0 or above 9.0 requires corrective measures. Specific information on the correct method of neutralizing low or high pH is available through Shaw Technical Services Department.
 - 2. <u>Moisture</u>: Check the concrete for moisture at several locations using the anhydrous calcium test kits. The moisture transmission rate must not exceed 5.0 pounds per 1000 square-feet per 24-hours. Do not begin the installation if an unacceptable moisture level is detected. Do not use other methods of moisture testing as they are not reliable. If excessive moisture is present, advise the Construction Manager.
- E. Do not proceed until unsatisfactory conditions are corrected.
- F. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to leave smooth, flat, hard surface.
- C. Prohibit traffic until filler is cured.
- D. Vacuum floor surface.

3.03 INSTALLATION

- A. Apply carpet and adhesive in accordance with manufacturers' instructions. Direct glue-down.
- B. Lay out rolls of carpet.
- C. Verify carpet match before cutting to ensure minimal variation between dye lots.
- D. Locate seams in area of least traffic. Carpet shall be installed in full lengths wherever possible.
- E. Fit seams straight, not crowded or peaked, free of gaps.
- F. Lay carpet on floors with run of pile in same direction as anticipated traffic. Lay carpet so that seams perpendicular to a wall do not occur at door openings in that wall.
- G. Do not change run of pile in any room where carpet is continuous through a wall opening into another room. Locate change of color or pattern between rooms under door centerline.
- H. Cut and fit carpet around interruptions.
- I. Fit carpet tight to intersection with vertical surfaces without gaps.
- J. All seams shall be beaded and sealed with "seam sealer". The seam sealer shall be applied to the cut edge of the carpet at the level of the carpet backing.
- K. No stretching will be permitted.

- L. Unroll carpet face up and cut the lengths required with pile-lay runs in the same direction. Check starting wall for squareness and allow for off-square walls. Strike chalk line the entire length of area where seam falls.
- M. Place two lengths in proper position for installing; trim salvage, and line up seam edge with chalk line. Lay carpet perfectly flat and tension free.
- N. Roll both widths back 3' from seam area the entire length of carpet.
- O. Spread adhesive from approximate center towards each end.
- P. When sufficient floor area has been covered with adhesive, drop or roll first width into place. Apply coating of edge sealer to seam edge of first width. Follow this procedure on each succeeding width at seam. Drop or roll second width into position and fit the seam in tightly using knee-kicker if necessary. Brush or roll looseness and air bubbles away from seam.
- Q. Fold or roll the remaining portion of the first width from the wall. Apply adhesive to the floor and drop or roll carpet into place.
- R. Roll or fold back dry portion of second width towards seam; spread adhesive and place carpet 3' from where next seam will fall.
- S. Brush or roll out looseness and air bubbles as carpet is put into place. Repeat above procedure on continuing widths. Trim carpet at wall using razor blade knife or suitable wall trimmer.

3.04 <u>CLEANING</u>

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.

3.05 PROTECTION

- A. Prohibit traffic from carpet areas for 24 hours after installation.
- B. Cover with non-staining building paper, firmly fastened down to protect floor surfaces.
- C. Near completion of the project, remove paper, clean and vacuum carpet.

END OF SECTION

SECTION 09 90 00 <u>PAINTING</u>

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all Painting, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section Includes: Painting and finishing of all interior and exterior items and surfaces, unless otherwise indicated or listed under exclusions below:
 - 1. Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated.
 - 2. Include field painting of exposed exterior and interior structural steel, plumbing, mechanical and electrical work, except as indicated below.
 - 3. Paint exterior plaster where indicated on Drawings.
- C. Work Included:

The intent and requirements of this section is that all work, items and surfaces which are normally painted and finished in a building of this type and quality, shall be so included in this contract, whether or not said work, item or surface is specifically called out and included in the schedules and notes on the drawings, or is, or is not, specifically mentioned in these specifications.

- D. The following general categories of work and items that are included under other sections, shall not be a part of this section:
 - 1. Shop prime painting of structural and miscellaneous iron or steel.
 - 2. Shop prime painting of hollow metal work.
 - 3. Shop finished work and items.
 - 4. Any drywall or plaster permanently concealed from view.
 - 5. Any factory finished equipment and other materials with a complete factory applied finish.
 - 6. Finish hardware except where primed for paint finish.
 - 7. Any glass, plastics, floor tiles and sheet vinyl coved or vinyl top set bases.
 - 8. Plumbing fixtures: Toilet room accessories.
 - 9. Lighting fixtures except as noted on drawings or specified.
 - 10. Any acoustical surfaces; unless otherwise specified.
- E. The Room Finish Schedules indicated on the drawings, indicates the location of interior room surfaces to be painted or finished. The schedule indications are general and do not necessarily define the detail requirements. Include all detailed refinements and further instructions as may be given for the required complete finishing of all spaces and rooms.

1.03 STANDARDS AND REFERENCES

A. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and

industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.

- B. Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to job going out to bid and before start of painting project.
- C. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the South Coast Air Quality Management District (SCAQMD). Field Sample: When and as directed by the Architect, apply one complete coating system for each color, gloss and texture required. When approved, the sample panel areas will be deemed incorporated into the Work and will serve as the standards by which the subsequent Work of this Section will be judged.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Materials List: Submit complete lists of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item when applicable. When required, provide a list of paint and coating materials proposed for use, which equates such materials with the design-basis products specified.
- D. Samples: Submit, on 8-1/2 inch by 11 inch hardboard, samples of each color, gloss, texture and material selected by the Architect from standard colors available for the coatings required. For natural and stained finishes, provide sample on each type and quality of wood used on the project.
- E. Manufacturer's Instructions: Submit the manufacturer's current recommended methods of installation, including relevant limitations, safety and environmental cautions, application rates, and composition analysis.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Storage and Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.
- D. Deliver materials to job site in new, original, and unopened containers bearing manufacturer's name and trade name. Store where directed in accordance with manufacturer's instructions.

1.08 PROJECT CONDITIONS

A. Do not apply exterior materials during fog, rain or mist, or when inclement weather is expected within the dry time specified by the manufacturer. No exterior or interior painting shall be done until the surfaces are thoroughly dry and cured. Do not apply paint when temperature is below 50° F. Avoid painting surfaces when exposed to direct sunlight.

1.09 OPERATION AND MAINTENANCE DATA

- A. Provide in accordance with Project Manual Volume One, Article 6.12 Record Documents.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Provide in accordance with Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- D. Coating Maintenance Manual: Provide a S-W Custodian or similar coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.10 EXTRA MATERIALS

- A. Provide in accordance with Project Manual Volume Four, Section 01 78 00.
- B. Provide 5% with a minimum of one gallon of each color and product used.

1.11 RECORD DRAWINGS

Not required.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Sherwin-Williams. Architectural representative: Rocky Berlanga; Phone (657) 269-0922 or Email rocky.m.berlanga@sherwin.com.
- B. Acceptable Manufacturers: Dunn Edwards, Vista Paint or Architect approved equal.

2.02 MATERIALS

- A. Paints: Provide Ready-Mixed, except field catalyzed coatings. Pigments shall be fully ground maintaining soft paste consistency, capable of being readily and uniformly dispersed to complete homogeneous mixture. Paints shall have good flowing and brushing properties and be capable of drying or curing free of streaks and sags.
- B. Accessory Materials: Linseed oil, shellac, solvents, and other materials not specified but required to achieve required finishes shall be of high quality and approved by manufacturer.
- C. Colors shall be selected from color chip samples provided by manufacturer of paint system approved for use. Match approved samples for color, texture and coverage.

2.03 <u>MIXES</u>

Mix, prepare, and store painting and finishing materials in accordance with manufacturer's directions.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Examine surfaces to be painted before beginning painting work. Work of other trades that has been left or installed in a condition not suitable to receive paint, stain, other specified finish shall be repaired or corrected by the applicable trade before painting. Painting of defective or unsuitable surface implies acceptance of the surfaces.
- C. Beware of a condition known as "critical lighting". This condition causes shadows that accentuate even the slightest surface variations. A pigmented sealer will provide tooth for succeeding decorative coating, but "does not" equalize smoothness or surface texture. Any corrective action to gypsum board/drywall must be done by the drywall contractor prior to decorating.
- D. Notify the Construction Manager and Architect in writing of any conditions detrimental to the proper and timely completion of the installation.
- E. Correct conditions detrimental to timely and proper completion of the Work.
- F. Do not proceed until unsatisfactory conditions are corrected.
- G. Beginning of installation means acceptance of conditions.

3.02 PROTECTION

- A. Protect previously installed work and materials, which may be affected by Work of this Section.
 - 1. Protect prefinished surfaces, lawns, shrubbery and adjacent surfaces against paint and damage.
 - 2. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or splatter from fouling surfaces not being painted.
 - 3. Protect surfaces, equipment, and fixtures from damage resulting from use of fixed, movable and hanging scaffolding, planking, and staging.
- B. Provide WET PAINT signs, barricades, and other devices required to protect newly finished surfaces. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.03 PREPARATION

- A. Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.
- B. Concrete and masonry surfaces shall be dry, clean, and free of dirt, efflorescence, encrustation, and other foreign matter. Glazed surfaces on concrete shall be roughened or etched to uniform texture.
- C. Ferrous metal shall be cleaned per SSPC-SP1. All welds, loosely adhered rust, and debris must be power tool cleaned per SSPC-SP3. Prime within 3 hours after preparation.
- D. Clean per SSPC-SP1 to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, power tool clean per SSPC-SP3 to remove these treatments.

- E. Remove dust, grit and foreign matter from wood surfaces. Sand surfaces and dust clean. Spot coat knots, pitch streaks, and sappy section with pigmented stain sealer when surfaces are to be painted. Fill nail holes, cracks and other defects after priming and spot prime repairs when fully cured.
- F. Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not-to-be-finish painted, or provide surface-applied protection. Reinstall removed items upon completion of work in each area.
- G. Existing surfaces to be recoated shall be thoroughly cleaned and de-glossed by sanding or other means prior to painting. Patched and bare areas shall be spot primed with same primer as specified for new work.
- H. Thoroughly backpaint all surfaces of exterior and interior finish lumber and millwork, including doors and window frames, trim, cabinetwork, etc., which will be concealed after installation. Backpaint items to be painted or enameled with the priming coat. Use a clear sealer for backpriming where transparent finish is required.
- I. Bar and covered pipes, ducts, hangers, exposed steel and ironwork, and primed metal surfaces of equipment installed under mechanical and electrical work shall be cleaned prior to priming.
- J. Preparation of other surfaces shall be performed following specific recommendations of the coatings manufacturer.
- K. Bond breakers and curing agents must be removed and the surface cleaned before primers, sealers or finish paints can be applied.
- L. All drywall surfaces must be completely dry and dust free before painting. Skim coated drywall must be sealed with an alkyd based sealer or a waterborne sealer recommended by the paint manufacturer for this surface. Use the appropriate light or medium tack masking tape.

3.04 APPLICATION

- A. Apply painting and finishing materials in accordance with the manufacturer's submittals, as approved. Use applicators and techniques best suited for the material and surfaces to which applied.
 - 1. The number of coats specified is the minimum that shall be applied. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.
 - 2. All undercoats shall be tinted slightly to approximate the color of the finish coat.
- B. Apply each material at not less than the manufacturer's recommended spreading rate:

Provide a total dry film thickness of not less than 1.2 mils for each required coat.

- C. Apply prime coat to surface, which is required to be painted or finished.
- D. Finish exterior doors on tops, bottoms, and edges same as exterior faces, after fitting.
- E. Sand lightly and dust clean between succeeding coats.

3.05 CLEANING, TOUCH-UP AND REFINISHING

- A. Carefully remove all spattering, spots and blemishes caused by work under this section from surfaces throughout the project.
- B. Upon completion of painting work remove all rubbish, paint cans, and accumulated materials resulting from work in each space or room. All areas shall be left in a clean, orderly condition.

C. Runs, sags, misses, holidays, stains and other defects in the painted surfaces, including inadequate coverage and mil thickness shall be satisfactorily touched up, or refinished, or repainted as necessary.

3.06 FINISH SCHEDULE

A. Apply the following finishes to the surfaces specified and/or as on the finish schedule on the Drawings. Apply all materials in accordance with manufacturer's instructions on properly prepared surfaces and foundation coats. All intermediate undercoats must be tinted to approximate the final color.

Architect will issue a color schedule prior to start of painting to designate the various colors and locations required for the work.

B. Exterior Systems:

1.

2.

<u>Stu</u> a.	i <u>cco & Plaster</u> Flat – 100% Acrylic	
	First Coat	Loxon Primer LX2W50
	Second Coat	A-100 Exterior Latex Flat A6 Series
	Inird Coat	A-100 Exterior Latex Flat A6 Series
b.	Semi-transparent Stain	
	First Coat	Loxon Vertical Semi-transparent Stain LX31T75
	Second Coat	Loxon Vertical Semi-transparent Stain LX31T75
	Third Coat	Loxon Vertical Semi-transparent Stain LX31T75
Col	ncrete Block	
a.	Flat – 100% Acrylic	
	First Coat	PrepRite Block Filler B25W25
	Second Coat	A-100 Exterior Latex Flat A6 Series
	Third Coat	A-100 Exterior Latex Flat A6 Series
h	Satin - 100% Acrulic	
ы.	First Coat	PrenRite Block Filler B25W25
	Second Coat	A-100 Exterior Latex Satin A82 Series
	Third Coat	A-100 Exterior Latex Satin A82 Series
C.	Gloss – 100% Acrylic	
	First Coat	PrepRite Block Filler B25W25
	Second Coat	A-100 Exterior Latex Gloss A8 Series
	Third Coat	A-100 Exterior Latex Gloss A8 Series
Ь	High Gloss High Perfor	mance – Acrylic/I Irethane
ч.	First Coat	Heavy Duty Block Filler B42W46
	Second Coat	Macropoxy 646-100 B58Series
	Third Coat	Acrolon 100 WB Polyurethane B65 Series
e.	Semi-transparent Stain	
	First Coat	Loxon Vertical Semi-transparent Stain LX31175
	Second Coal	Loxon Vertical Semi-transparent Stain LX31175
	minu Coat	Lozon vertical Semi-transparent Stain LX31175
Fer	rous Metal	

a.Flat – AcrylicFirst CoatProCryl Universal Acrylic Metal Primer B66-310Second CoatA-100 Exterior Latex Flat A6 SeriesThird CoatA-100 Exterior Latex Flat A6 Series

5.

b.	Semi-Gloss – Acrylic First Coat Second Coat Third Coat	ProCryl Universal Acrylic Metal Primer B66-310 Solo Acrylic Latex Semigloss A76 Series Solo Acrylic Latex Semigloss A76 Series
C.	Gloss – Acrylic First Coat Second Coat Third Coat	ProCryl Universal Acrylic Metal Primer B66-310 Solo Acrylic Latex Gloss A77 Series Solo Acrylic Latex Gloss A77 Series
d.	Gloss – Rust Preventat First Coat Second Coat Third Coat	tive Acrylic ProCryl Universal Acrylic Metal Primer B66-310 ProIndustrial Acrylic Gloss B66-600 Series ProIndustrial Acrylic Gloss B66-600 Series
e.	Gloss, Industrial High P First Coat Second Coat Third Coat	erformance – Inorganic Zinc/Epoxy/Acrylic ZincClad III HS-100 B69 Series Macropoxy 646-100 B58 Series ProIndustrial Acrylic Gloss B66-600 Series
f.	Matte, Industrial High P (VOC compliant in SCA First Coat Second Coat Third Coat	erformance – Epoxy Primer/Epoxy/Acrylic QMD) Macropoxy 646-100 B58 Series Macropoxy 646-100 B58 Series ProIndustrial Acrylic Eg-shel B66-660 Series
g.	High Gloss, Industrial H (VOC compliant in SCA First Coat Second Coat Third Coat	igh Performance – Inorganic Zinc/Epoxy/Urethane QMD) ZincClad III HS-100 B69 Series Macropoxy 646-100 B58 Series Acrolon 100 WB Polyurethane B65 Series
h.	High Gloss, Industrial H (VOC compliant in SCA First Coat Second Coat Third Coat	igh Performance – Epoxy Primer/Epoxy/Urethane QMD) Macropoxy 646-100 B58 Series Acrolon 100 WB Polyurethane B65 Series Acrolon 100 WB Polyurethane B65 Series
<u>Gal</u> a.	<u>vanized Metal</u> Flat – Acrylic Pretreatment First Coat Second Coat Third Coat	GLL Clean n Etch ProCryl Universal Acrylic Metal Primer B66-310 A-100 Exterior Latex Flat A6 Series A-100 Exterior Latex Flat A6 Series
b.	Semi-Gloss – Acrylic Pretreatment First Coat Second Coat Third Coat	GLL Clean n Etch ProCryl Universal Acrylic Metal Primer B66-310 Solo Acrylic Latex Semigloss A76 Series Solo Acrylic Latex Semigloss A76 Series
C.	Gloss – Acrylic Pretreatment First Coat Second Coat Third Coat	GLL Clean n Etch ProCryl Universal Acrylic Metal Primer B66-310 Solo Acrylic Latex Gloss A77 Series Solo Acrylic Latex Gloss A77 Series

6.

		d.	Gloss – Rust Preventat First Coat Second Coat Third Coat	ive Acrylic ProCryl Universal Acrylic Metal Primer B66-310 ProIndustrial Acrylic Gloss B66-600 Series ProIndustrial Acrylic Gloss B66-600 Series
		e.	Matte, Industrial High P (VOC compliant in SCA First Coat Second Coat Third Coat	erformance – Epoxy Primer/Acrylic QMD) Macropoxy 646-100 B58 Series ProIndustrial Acrylic Eg-shel B66-660 ProIndustrial Acrylic Eg-shel B66-660
		f.	High Gloss, Industrial H First Coat Second Coat Third Coat	ligh Performance – Epoxy Primer/Urethane Macropoxy 646-100 B58 Series Acrolon 100 WB Polyurethane B65 Series Acrolon 100 WB Polyurethane B65 Series
	7.	<u>Wo</u> a.	<u>od – Paint Finish</u> Semi-Gloss – Acrylic First Coat Second Coat Third Coat	PrepRite ProBlock Primer B51W8020 Solo Acrylic Latex Semigloss A76 Series Solo Acrylic Latex Semigloss A76 Series
		b.	Gloss – Acrylic First Coat Second Coat Third Coat	PrepRite ProBlock Primer B51W8020 Solo Acrylic Latex Gloss A77 Series Solo Acrylic Latex Gloss A77 Series
	8.	<u>Wo</u> Tw	<u>od – Stain Finish – Opac</u> o Coats	<u>que:</u> WoodScapes Water-based Solid Stain A15
	9.	<u>Wo</u> On	ood <u>– Stain Finish – Sem</u> e Coat	<u>i-Transparent:</u> WoodScapes Ext Semi-transparent Stain A15T
C.	Interior	Sys	tems:	
	1.	<u>Gy</u> a.	<u>psum Board</u> Flat – Acrylic First Coat Second Coat Third Coat	PVA Primer B28W8000 ProMar 200 Zero VOC Flat B30-2600 ProMar 200 Zero VOC Flat B30-2600
		b.	Low Sheen – Acrylic First Coat Second Coat Third Coat	PVA Primer B28W8000 ProMar 200 Zero VOC Low Sheen B24-2600 ProMar 200 Zero VOC Low Sheen B24-2600
		c.	Eggshell – Acrylic First Coat Second Coat Third Coat	PVA Primer B28W8000 ProMar 200 Zero VOC Eg-shel B20-2600 ProMar 200 Zero VOC Eg-shel B20-2600
		u.	First Coat Second Coat Third Coat	PVA Primer B28W8000 ProMar 200 Zero VOC Semigloss B31-2600 ProMar 200 Zero VOC Semigloss B31-2600

e. Gloss – Acrylic

First Coat	PVA Primer B28W8000
Second Coat	ProMar 200 Zero VOC Gloss B21-12650
Third Coat	ProMar 200 Zero VOC Gloss B21-12650

- f. Gloss– Industrial High Performance Waterborne Epoxy First Coat ProMar 200 Zero VOC Primer B28W2600 Second Coat WB Catalyzed Epoxy Gloss B73 Series Third Coat WB Catalyzed Epoxy Gloss B73 Series
- g.High Gloss Industrial High Performance Waterborne Epoxy/UrethaneFirst CoatMacropoxy 646-100 B58 SeriesSecond CoatAcrolon 100 WB Polyurethane B65 SeriesThird CoatAcrolon 100 WB Polyurethane B65 Series
- 2. <u>Concrete & Plaster</u>:

a.	Flat – Acrylic Copolyme	er
	First Coat	Loxon Primer LX2W50
	Second Coat	ProMar 200 Zero VOC Flat B30-2600
	Third Coat	ProMar 200 Zero VOC Flat B30-2600

b.	Low Sheen – Acrylic Co	opolymer
	First Coat	Loxon Primer LX2W50
	Second Coat	ProMar 200 Zero VOC Low Sheen B24-2600
	Third Coat	ProMar 200 Zero VOC Low Sheen B24-2600

c.	2. Eggshell –Acrylic Copolymer	
	First Coat	Loxon Primer LX2W50
	Second Coat	ProMar 200 Zero VOC Eg-shel B20-2600
	Third Coat	ProMar 200 Zero VOC Eg-shel B20-2600

d.	Semi-Gloss –Acrylic Co	ppolymer
	First Coat	Loxon Primer LX2W50
	Second Coat	ProMar 200 Zero VOC Semigloss B31-2600
	Third Coat	ProMar 200 Zero VOC Semigloss B31-2600

e.	Gloss – 100% Acrylic	
	First Coat	Loxon Primer LX2W50
	Second Coat	ProMar 200 Zero VOC Gloss B21-12650
	Third Coat	ProMar 200 Zero VOC Gloss B21-12650

- f. Gloss Industrial High Performance Waterborne Epoxy First Coat Loxon Primer LX2W50 Second Coat WB Catalyzed Epoxy Gloss B73 Series Third Coat WB Catalyzed Epoxy Gloss B73 Series
- g.High Gloss- Industrial High Performance Epoxy/UrethaneFirst CoatMacropoxy 646-100 B58 SeriesSecond CoatAcrolon 100 WB Polyurethane B65 SeriesThird CoatAcrolon 100 WB Polyurethane B65 Series

4. Concrete Block

a.	Flat – Acrylic Copolyme	er
	First Coat	PrepRite Block Filler B25W25
	Second Coat	ProMar 200 Zero VOC Flat B30-2600
	Third Coat	ProMar 200 Zero VOC Flat B30-2600

b.	Low Sheen – Acrylic Co First Coat Second Coat Third Coat	polymer PrepRite Block Filler B25W25 ProMar 200 Zero VOC Low Sheen B24-2600 ProMar 200 Zero VOC Low Sheen B24-2600
C.	Eggshell –Acrylic Copol First Coat Second Coat Third Coat	ymer PrepRite Block Filler B25W25 ProMar 200 Zero VOC Eg-shel B20-2600 ProMar 200 Zero VOC Eg-shel B20-2600
d.	Semi-Gloss –Acrylic Co First Coat Second Coat Third Coat	polymer PrepRite Block Filler B25W25 ProMar 200 Zero VOC Semigloss B31-2600 ProMar 200 Zero VOC Semigloss B31-2600
e.	Gloss – 100% Acrylic First Coat Second Coat Third Coat	PrepRite Block Filler B25W25 ProMar 200 Zero VOC Gloss B21-12650 ProMar 200 Zero VOC Gloss B21-12650
f.	Gloss – Industrial High I First Coat Second Coat Third Coat	Performance - Waterborne Epoxy PrepRite Block Filler B25W25 WB Catalyzed Epoxy Gloss B73 Series WB Catalyzed Epoxy Gloss B73 Series
g.	High Gloss- Industrial H First Coat Second Coat Third Coat	igh Performance – Acrylic/Urethane Heavy Duty Block Filler B42W46 Macropoxy 646-100 B58 Series Acrolon 100 WB Polyurethane B65 Series
For	rous Metal	
<u>a.</u>	Flat – Acrylic Copolyme First Coat Second Coat Third Coat	r ProCryl Universal Acrylic Metal Primer B66-310 ProMar 200 Zero VOC Flat B30-2600 ProMar 200 Zero VOC Flat B30-2600
b.	Low Sheen –Acrylic Co First Coat Second Coat Third Coat	polymer ProCryl Universal Acrylic Metal Primer B66-310 ProMar 200 Zero VOC Low Sheen B24-2600 ProMar 200 Zero VOC Low Sheen B24-2600
C.	Eggshell –Acrylic Copol First Coat Second Coat Third Coat	ymer ProCryl Universal Acrylic Metal Primer B66-310 ProMar 200 Zero VOC Eg-shel B20-2600 ProMar 200 Zero VOC Eg-shel B20-2600
d.	Semi-Gloss – Acrylic Pr First Coat Second Coat Third Coat	imer/ Acrylic Copolymer ProCryl Universal Acrylic Metal Primer B66-310 ProMar 200 Zero VOC Semigloss B31-2600 ProMar 200 Zero VOC Semigloss B31-2600
e.	Semi-Gloss –Rust Preve First Coat Second Coat Third Coat	entative Acrylic ProCryl Universal Acrylic Metal Primer B66-310 ProIndustrial Acrylic SemiGloss ProIndustrial Acrylic SemiGloss

f. Gloss – Acrylic Primer /100% Acrylic

5.

First Coat	ProCryl Universal Acrylic Metal Primer B66-310
Second Coat	Solo Acrylic Latex Gloss A77 Series
Third Coat	Solo Acrylic Latex Gloss A77 Series

g.	Gloss –Rust Preventative Acrylic	
-	First Coat	ProCryl Universal Acrylic Metal Primer B66-310
	Second Coat	ProIndustrial Acrylic Gloss
	Third Coat	ProIndustrial Acrylic Gloss

- h.Gloss Industrial High Performance Waterborne EpoxyFirst CoatProCryl Universal Acrylic Metal Primer B66-310Second CoatWB Catalyzed Epoxy Gloss B73 SeriesThird CoatWB Catalyzed Epoxy Gloss B73 Series
- i. High Gloss Industrial High Performance Epoxy/Urethane First Coat Macropoxy 646-100 B58 Series Second Coat Acrolon 100 WB Polyurethane B65 Series Third Coat Acrolon 100 WB Polyurethane B65 Series
- 6. Wood Paint Finish

a.	Flat – Acrylic Copolymer	
	First Coat	PrepRite ProBlock Primer B51W8020
	Second Coat	ProMar 200 Zero VOC Flat B30-2600
	Third Coat	ProMar 200 Zero VOC Flat B30-2600

b.	 Low Sheen – Acrylic Copolymer 	
	First Coat	PrepRite ProBlock Primer B51W8020
	Second Coat	ProMar 200 Zero VOC Low Sheen B24-2600
	Third Coat	ProMar 200 Zero VOC Low Sheen B24-2600

C.	Eggshell – Acrylic Copolymer	
	First Coat	PrepRite ProBlock Primer B51W8020
	Second Coat	ProMar 200 Zero VOC Eg-shel B20-2600
	Third Coat	ProMar 200 Zero VOC Eg-shel B20-2600

d.	Semi-Gloss – 100% Acrylic	
	First Coat	PrepRite ProBlock Primer B51W20
	Second Coat	Solo Acrylic Latex Semigloss A76 Series
	Third Coat	Solo Acrylic Latex Semigloss A76 Series

e. Semi-Gloss – Alkyd – Class A Fire Retardant First Coat Please contact your Sherwin-Williams representative for Second Coat fire retardant wood finish information. Third Coat

f.	Gloss – 100% Acrylic		
	First Coat	PrepRite ProBlock Primer B51W8020	
	Second Coat	Solo Acrylic Latex Gloss A77 Series	
	Third Coat	Solo Acrylic Latex Gloss A77 Series	

7. <u>Wood – Stain & Lacquer</u>

(VOC Rule in SCAQMD is 275 g/L for field-applied coatings)

a.	Flat	
	First Coat	SherWood BAC Wiping Stain S64
	Filler	Jasco Paste Wood Filler
	Second Coat	KemAqua Lacquer Sanding Sealer T65F520

Third Coat	KemAqua Dull Rub Clear Lacquer T75F528
Fourth Coat	KemAqua Dull Rub Clear Lacquer T75F528

- b.Semi-GlossFirst CoatSherWood BAC Wiping Stain S64FillerJasco Paste Wood FillerSecond CoatKemAqua Lacquer Sanding Sealer T65F520Third CoatKemAqua Semigloss Clear Lacquer T75F526Fourth CoatKemAqua Semigloss Clear Lacquer T75F526
- c. Gloss First Coat Filler Second Coat Third Coat Fourth Coat Second Coat Third Coat Fourth Coat Second Coat Fourth Coat Second Coat Fourth Coat Fourth Coat Second Coat Fourth Coat Fourth Coat Fourth Coat Second Coat Fourth Coat Second Coat Fourth Coat Second Coat Fourth Coat Second Coat Fourth Coat Second Coat Fourth Coat Second Coat Fourth Coat Second Coat Fourth Coat Second Coat Sec

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all exterior and interior signage, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete and proper installation.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.

C. Provide:

- 1. Shop Drawings: Provide shop drawings for review and approval prior to commencement of fabrication.
- 2. Samples: Provide to illustrate full size sample sign, of type, style and color specified including method of attachment.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Package signs, labeled in name groups.
- D. Store adhesive tape at ambient room temperatures.

1.08 PROJECT CONDITIONS

A. Do not install signs when ambient temperature is below 70 degrees F. Maintain this minimum during and after installation of signs.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.11 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 MATERIALS – EXTERIOR BUILDING SIGNAGE

- Basis of Design: A.R.K. Ramos Architectural Signage Systems; Oklahoma City, OK 73109; Tel: (800) 725-7266. Website: www.arkramos.com
- B. Or Architect approved equal.
- C. Letters and/or Numbers Font/Size/Finish/Color: as indicated in Drawings.
- D. Material: Aluminum Channel Letter
- E. Mounting: Brackets, PPM-1 bracket sleeved stud.
 - 1. Set in adhesive in masonry.
 - 2. Attach to support in framed wall.

2.02 MATERIALS – ROOM IDENTIFICATION SIGNAGE

- A. Refer to Signage Plan for types and locations.
- B. Material: 1/8" thick ES Plastic.
- C. Size and color: As indicated in Drawings
- D. Graphics: Vinyl die-cut. Font to be 3/4" Helvetic Medium, All Caps.
- E. All signage to have 1/2" radius corners
- F. Mounting: Adhesive

G. All signs installed on glass shall have a full-size backing plate adhered to the opposite side of the glass of the same color as the sign.

2.03 MATERIALS – INTERIOR ADA SIGNAGE

- A. Types and locations: As indicated in Drawings, conforming to requirements of the California Building Code.
- B. Material: 1/8" thick ES Plastic.
- C. Text and font, size and color: As indicated in Drawings
- D. Graphics: To be vinyl die-cut.
- E. All signs to have 1/2" Radius corners
- F. Mounting: Adhesive
- G. All signs installed on glass shall have a full size backing plate adhered to the opposite side of the glass of the same color as the sign.

2.04 DEDICATION PLAQUE

Refer to Drawings for location, size, text, and material details.

2.05 <u>ACCESSORIES</u>

- A. Mounting Hardware: Chrome screws; base sleeve and studs per manufacturer's recommendations.
- B. Tape Mount: Double sided tape, permanent adhesive.
- C. Adhesive: Silastic adhesive as recommended by manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify adequate support for Building Signs. Coordinate footings with other trades.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install signs after doors and surfaces are finished, in locations indicated.
 - 1. Furnish and install all anchorage devices required to install the item and its appurtenances complete. Provide anchorage in ample time when required to be built in by other trades.
 - 2. All wall-mounted items shall be securely fastened to solid backing or blocking.
- C. Center plastic signs on doors, level.
- D. Anchor all components firmly into position for long life under hard use.
- E. Clean and polish.

END OF SECTION

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SECTION 10 26 00

WALL PROTECTION SYSTEMS

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all Corner Guards, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete and proper installation.
- B. Section includes, but is not limited to:
 - 1. Corner Guards

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

- A. Installer qualifications: Engage an installer who has experience in installation of systems similar in complexity to those required for this project.
- B. Manufacturer's qualifications: Not less than 5 years of experience in the production of specified products and a record of successful in-service performance.
- C. Code compliance: Assemblies should conform to all applicable codes including IBC, UBC, SBCCI, BOCA, Life Safety and CA 01350.
- D. Fire performance characteristics: Provide wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E 648/NFPA 253 (Critical Radiant Flux) – Class 1.
- E. Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D543.
- F. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Product data and detailed specifications for each system component and installation accessory required, including installation methods for each type of substrate.

- D. Product test reports from a qualified independent testing laboratory showing compliance of each component with requirements indicated.
- E. Shop drawings showing locations, extent and installation details of wall covering products.
- F. Samples of each product specified for verification purposes: Submit samples as proposed for this work, for verification of color, texture, pattern and thickness.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.
- D. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 55 degrees F (13 degrees C) or more than 85 degrees F (29 degrees C).
- E. Materials must be stored flat.

1.08 PROJECT CONDITIONS

- A. Materials must be acclimated in an environment of 65-75 degrees F (18-24 degrees C) for at least 24 hours prior to beginning installation.
- B. Installation areas must be enclosed and weatherproofed before installation commences.
- C. Install products after other finishing operations, including painting, have been completed.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

- A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.
- B. Provide 5 percent extra material for each type, color, pattern and accessory.

1.11 RECORD DRAWINGS

Not required.

1.12 <u>WARRANTY</u>

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Provide Limited 2 year warranty provided by the manufacturer.

PART 2 - PRODUCTS

2.01 <u>MATERIALS</u>

- A. Basis of Design: Johnsonite, a brand of Tarkett. 30000 Aurora Road, Solon, Ohio 44139. Phone: 800-899-8916. Website: www.tarkettna.com. Email: info@johnsonite.com
- B. Or Architect approved equal.

2.02 CORNER GUARD

- A. Resilient Vinyl Corner Bumper Guard
 - 1. Homogeneous vinyl polymer construction
 - 2. Style/Model: VBG-XX-A, 90 degree angular shaped profile with 1-1/2" return legs, 1/8" leg thickness.
 - 3. Length: As indicated in the Drawings
 - 4. Color: As indicated in the Drawings

2.03 INSTALLATION ACCESSORIES

A. Adhesive: 946 Premium Contact Adhesive as manufactured by Tarkett.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.
- B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install the work of this section in strict accordance with the manufacturer's recommendations using approved adhesive where applicable.
- B. Temperature at the time of installation must be between 65-75 degrees F (18-24 degrees C) and be maintained for at least 48 hours after the installation to allow for proper adhesive set-up.
- C. Relative humidity shall not exceed 80 percent.

3.04 CLEANING AND PROTECTION

- A. General: Immediately upon completion of installation, clean material in accordance with manufacturer's recommended cleaning method.
- B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

C. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed with out leaving residue or permanent stains.

END OF SECTION
SECTION 10 28 13

TOILET ACCESSORIES

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK

Supply and install all Toilet Accessories, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.

1.03 STANDARDS AND REFERENCES

- A. Comply with the Industry Standards and References as established by Manufacturer.
- B. Regulatory: Conform to Title 24 and City codes for installing work in conformance with ANSI A117.1

1.04 QUALITY ASSURANCE

- A. Comply with the Standard requirements established by Manufacturer.
- B. Coordinate the work of this Section with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Provide, within 35 days of Notice to Proceed, product data on accessories describing size, finish, details of function, attachment methods.
- D. Submit shop drawings, manufacturer's literature and brochures, and catalog cuts, showing complete details of all manufactured and fabricated items. Do not purchase items until the shop drawings have been approved. See Section "Samples and Shop Drawings" for number and manner of submittals.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and

Equipment.

1.08 PROJECT CONDITIONS

- A. Materials must be acclimated in an environment of 65-75°F (18-24°C) for at least 24 hours prior to beginning the installation.
- B. Installation areas must be enclosed and weatherproofed before installation commences.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

- A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.
- B. Supply two (2) keys for each accessory to Owner. Master Key all accessories.

1.11 RECORD DRAWINGS

Not required.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Bobrick Washroom Equipment, Inc.;
- B. Approved alternate: Bradley Corporation or Architect approved equal.

2.02 <u>MATERIALS</u>

- A. Stainless Steel Sheet: ASTM A167, Type 304.
- B. Tubing: ASTM A269, stainless steel.
- C. Fasteners, Screws, and Bolts: Hot dip galvanized as recommended by manufacturer.
- D. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.
- E. Factory Finishing: Stainless Steel, No. 4 satin luster finish.

2.03 PRODUCTS

As indicated on the Toilet Accessories Schedule in the Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that site conditions are ready to receive work and dimensions are as instructed by the manufacturer.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- B. Provide complete information, diagrams, templates, and instructions for the installation of all items, in sufficient time so that all backing, blocking, framing and formwork can be properly installed, and so that the work of other trades will not be delayed.
- C. Verify exact location of accessories for installation.

3.03 INSTALLATION

- A. Install the work of this Section in strict accordance with the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life under hard use.
 - 1. Furnish and install all anchorage devices required to install the item and its appurtenances complete. Provide anchorage in ample time when required to be built in by other trades.
 - 2. All wall-mounted items shall be securely fastened to solid backing or blocking.
- B. Install fixtures, accessories and items in accordance with manufacturer's instructions.
- C. Install plumb and level, securely and rigidly anchored to substrate.

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SECTION 10 41 00

EMERGENCY ACCESS CABINETS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Emergency Access Cabinets (also known as Knox Boxes), as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Product Data: Provide Manufacturer's descriptive and technical data and installation details.
- D. Confirm acceptance of local Fire Marshall.

1.07 DELIVERY, STORAGE AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

A. Project Manual Volume One, Article 6.12 – Record Documents.

- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- 1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 <u>WARRANTY</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 MATERIAL

- A. Basis of Design: Knox Company
 - 1. Construction: Heavy-duty, high security
 - 2. Door: 5/8 inch solid steel with gasket
 - 3. Size: 9 1/2 inches high x 9 1/2 inches wide x 5 inches deep
 - 4. Mounting: Recessed
 - 5. Finish: Aluminum Finish
- B. Models:
 - 1. Model #4400 at Doors
 - 2. Model #3770 at Gates
 - 3. Vehicular Gate Key Control Switch: Know #3502
- C. Fastenings: Non-ferrous, type to suit installation conditions

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

- A. Install lock boxes at locations indicated in accordance with manufacturer's instructions.
- B. Securely fasten in place with sides plumb and level.

C. Exposed surfaces shall be free from scratches, tool marks, and other damage and defects.

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SECTION 10 44 00 FIRE PROTECTION SPECIALTIES

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Fire Extinguishers and Cabinets, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer

1.04 QUALITY ASSURANCE

- A. Conform to NFPA 10 requirements for extinguishers.
- B. Provide fire extinguishers, cabinets, and accessories by single manufacturer.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Submit the following:
 - 1. Physical dimensions, operational features, color and finish, wall-mounting brackets with mounted measurements, anchorage details, rough-in measurements, location, and details.
 - 2. Manufacturer's installation instructions.
 - 3. Manufacturer's operation and maintenance data.
 - 4. Include test, refill or recharge schedules, procedure, and re-certification requirements.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Do not install extinguishers when ambient temperatures may cause freezing.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

A. Project Manual Volume One, Article 6.12 – Record Documents.

- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- 1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design: Larsen's Manufacturing Company, 7421 Commerce Lane, N.E. Minneapolis, MN. 55432. Website: www.larsensmfg.com. Phone: 1-800-527-7367.
- B. Or Architect approved equal.

2.02 EXTINGUISHERS

Multi-Purpose Chemical Type: Larsen's Steel tank, Model MP 5, with pressure gage, and UL Rating 2A-10B:C or approved equal.

2.03 <u>CABINETS</u>

Typical Extinguisher Cabinet:

- A. Provide Larsen's 2409-5R Vertical Duo Door Panel cabinet.
- B. Primer finish.

2.04 ACCESSORIES

- A. Mounting Hardware: Appropriate to cabinet see manufacturer's installation instructions.
- B. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

2.05 FABRICATION

- A. Form body of cabinet with tight inside corners and seams.
- B. Pre-drill holes for anchorage.
- C. Form perimeter trim and door stiles by welding, filling, and grinding smooth.
- D. Hinge doors for 180 degree opening.
- E. Glaze doors with resilient channel gasket glazing.

2.06 FINISHES

- A. Extinguisher: Red enamel.
- B. Cabinet Trim and Door: Primed to be painted to match adjacent surface.
- C. Cabinet Interior: Enamel white.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that rough openings for cabinet are correctly sized and located.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

- A. Install cabinets plumb and level in wall openings so that there is 54 inches from finished floor to door handle.
- B. Secure rigidly in place in accordance with manufacturer's instructions.

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SECTION 10 51 13

METAL LOCKERS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Lockers, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete and proper installation.

1.03 STANDARDS AND REFERENCES

ADAAG – Americans with Disabilities Act, Accessibility Guidelines.

1.04 QUALITY ASSURANCE

Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Shop Drawings: Show the following:
 - 1. Dimensioned drawings including plans, elevations, and sections to show locker locations and interfaces with adjacent substrates.
 - 2. Details of assembly, erection, anchorage and clearance requirements.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and finishes.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Store products in manufacturer's unopened packaging until ready for installation.
- D. Protect locker finish and adjacent surfaces from damage.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 <u>MANUFACTURERS</u>

- A. Basis of Design: Penco Products, Inc., 1820 Stonehenge Drive, Greenville, NC 27858; Toll Free Tel: 800-562-1000; Fax: 800-248-1555; Email:general@pencoproducts.com; Web: www.pencoproducts.com
- B. Or Architect approved equal.

2.02 MATERIALS

- A. Steel: Prime grade mild cold-rolled sheet steel free from surface imperfection, capable of taking a high-grade enamel finish and in compliance with ASTM A1008.
- B. Steel: Sheet steel components shall be fabricated using zinc-coated steel free from surface imperfection, capable of taking a high-grade enamel finish and in compliance with ASTM A879.
- C. Bolts and Nuts: Zinc plated truss fin head bolts and hex nuts.
- D. Provide only metal lockers fabricated in the United States by a single domestic manufacturer.

2.03 HEAVY DUTY PERSONAL DUFFEL LOCKERS

- A. Heavy Duty Lockers: All locker body components made of cold rolled steel specially formed for added strength and rigidity and to ensure tight joints at fastening points.
- B. Locker Body Construction: Steel specially formed for added strength and rigidity and to ensure tight joints at fastening points.
 - 1. Sides, Bottoms and Tops:
 - a. 16 gauge steel.
 - 2. Backs: Solid 18 gauge steel. One-piece through 42 inches (1066.8 mm) wide; supplied as two 24 inch (609.6 mm) panels on 48 inch (1219.2 mm) wide lockers.

- 3. Doors:
 - a. 14 gauge steel. One piece sheet steel.
 - b. Ventilation: Louvers 6 inch (152.4 mm) wide by 3/4 inch high (19.05 mm) high horizontal louvers arranged in two groups of 3.
 - c. Provide holes for attaching number plates.
- 4. Tops and bottoms with three sides formed 90 degrees, the front offset formed to be flush with horizontal frame member.
- 5. Hole Spacing in Locker Body Construction: Not exceeding 9 inches (228.6 mm).
- 6. Optional factory assembly of locker bodies using rivets.
- C. Hinges:
 - 1. Continuous type: 16 gauge piano hinge measuring full height of door. Welded to door and attached to locker frame using steel rivets.

2.04 DOOR HANDLES AND LATCHING

- A. Two, Three and Four Tier Lockers:
 - 1. Cremone Latching: Handle shall be a heavy duty turn handle that engages the door frame on three sides. The top and bottom frames are engaged with 3/8 inch (9.5 mm) steel rods, and a 1/8 inch (3 mm) thick center latch engages at the side.
 - a. Double door configurations shall consist of a left hinged door secured its full length by the right hinged door when latched.
 - b. Handle assembly shall be secured to door using a threaded lock nut to facilitate adjustment and removal for repair if necessary. Welded handle assemblies shall not be accepted.
 - c. Double door configurations delivered knocked down will have doors shipped separately for attachment on site using supplied hardware.
 - d. Provide lock hole cover plate for use with padlocks.

2.05 <u>ACCESSORIES</u>

- A. Number Plates: Provide each locker with a polished aluminum number plate, 2-1/4 inches (57.15 mm) wide by 1 inch (25.4 mm) high, with black numerals not less than 3/8 inch (9.5 mm) high; attach to face of door with two aluminum rivets.
- B. Locks: Built-in flat key locks; master-key to same series.
- C. Locks: Built-in grooved key locks (pin tumbler); master-key to same series.
- D. Locks: Built-in three-number dialing combination locks capable of at least five different combination changes; provide master key, combination change key, and combination control charts.
- E. Padlocks: Master-keyed three-number dialing combination type padlocks; provide master key.
- F. Finished End Panels: Minimum 16 gauge steel formed to match locker depth and height, 1 inch (25.4 mm) edge dimension; finish to match lockers. Install with concealed fasteners.
- G. Front Fillers: 20 gauge steel formed in an angle shape, with 20 gauge slip joint angles formed in an angle shape with double bend on one leg forming a pocket to provide adjustable mating with angle filler.
 - 1. Attachment by means of concealed fasteners.
 - 2. Finish to match lockers.

- H. Recess Trim: 18 gauge steel, 3 inch (76.2 mm) face dimension.
 - 1. Vertical and/or horizontal as required.
 - 2. Standard lengths as long as practical.
 - 3. Attach to lockers with concealed clips.
 - 4. Provide necessary finish caps and splices.
 - 5. Finish to match lockers.

2.06 FABRICATION

- A. Fabricate lockers square, rigid, without warp, with metal faces flat and free of distortion.
- B. Knock-Down Lockers: Fabricate lockers on the one wide unit principle, each locker with individual door and frame, individual top, bottom, back, and sides. 48" (1219.2 mm) wide backs come as two 24" (609.6 MM) wide pieces. Verify dimensions and arrangement before fabrication.
- C. Finish: Enamel powder coat paint finish electrostatically applied and properly cured to manufacturer's specifications for optimum performance. Finishes containing volatile organic compounds and subject to out-gassing are not acceptable. Locker exterior and interior shall be painted the same color.
 - 1. Powder Coat Dry Thickness: 1 to 1.2 mils.
 - 2. Color: As selected from manufacturer's standard colors.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates and bases have been properly prepared.
- B. If substrate and bases are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

- A. Install metal lockers and accessories at locations shown in accordance with manufacturer's instructions.
- B. Install lockers plumb, level, and square. Work is not to progress until site meets necessary conditions.
- C. Anchor lockers to floor and/or wall at 36 inches (914.4 mm) or less, as recommended by the manufacturer.
- D. Bolt adjoining locker units together to provide rigid installation.
- E. Install sloping tops and metal fillers using concealed fasteners. Provide flush hairline joints against adjacent surfaces.
- F. Install benches by fastening bench tops to pedestals and securely anchoring to the floor using appropriate anchors for the floor material.

3.03 ADJUSTING AND CLEANING

- A. Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.
- B. Adjust built-in locks to prevent binding of dial or key and ensure smooth operation prior to substantial completion.

C. Touch-up with factory-supplied paint and repair or replace damaged products before substantial completion.

3.04 PROTECTION

A. Protect installed products until completion of project.

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SECTION 10 75 00

FLAGPOLES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all Flagpoles, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. System description:
 - 1. Type: Ground set, fixed type.
 - 2. Pole Design: Cone tapered
 - 3. Nominal Height: As indicated in the Drawings
 - 4. Halyard: Internal type.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Design flagpole foundation, supports under direct supervision of a Professional Structural Engineer experienced in design of this work, registered in the state of California.
- C. Pole with Flag Flying: Resistant without permanent deformation, 90-miles/hr. wind velocity, non-resonant, safety design factor of 2.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Provide product data on pole, accessories, and configurations.
- D. Submit manufacturer's installation instructions.
- E. Indicate on shop drawings, detailed dimensions, base attachment details, anchor requirements, and imposed loads.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- D. Protect flagpole and accessories on site from damage or moisture.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. L.A. Steelcraft
- B. Eder Flag.
- C. Or Architect approved equal.

2.02 POLE MATERIALS

Aluminum: 6063 alloy, T6 temper. Dark bronze anodized.

2.03 COMPONENTS AND ACCESSORIES

- A. Finial Ball: Gold tone, 6-inch diameter.
- B. Truck Assembly: Cast aluminum or Stainless steel; revolving; stainless steel ball bearings, non-fouling.

- C. Flag(s): Provided by Owner.
- D. Halyard: 1/8-inch diameter stainless steel cable.

2.04 MOUNTING COMPONENTS

- A. Pole Base Attachment: Sleeve with base cover.
- B. Lightning Ground Rod and Cable: As recommended by manufacturer.

2.05 POLE FABRICATION

- A. Outside Butt Diameter: 6 inches.
- B. Outside Tip Diameter: 3-1/2 inches.
- C. Nominal Thickness: 188 inches.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings and instructed by the manufacturer.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance conditions.

3.02 PREPARATION

Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

- A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.
- B. Electrically ground flagpole installation.
- C. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

3.04 TOLERANCES

Maximum variation from plumb: One inch.

3.05 ADJUSTING AND CLEANING

- A. Clean surfaces.
- B. Adjust operating devices so that halyard and flag function smoothly.

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SECTION 11 31 13 APPLIANCES

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Appliances, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.

1.03 STANDARDS AND REFERENCES

- A. ANSI A117-1 Guidelines for Accessible and Useable Buildings and Facilities.
- B. EPA Energy Star Appliances.
- C. Public Law 101-336 Americans with Disabilities Act.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with referenced standards and the Americans with Disabilities Act as applicable for fixtures for the disabled.
- B. Energy Rating: Provide appliances with the EPA Energy Star label where applicable.
- C. Coordinate rough-in requirements with adjacent construction. Coordinate components and fittings to ensure compatible parts are installed.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Model number and selected options for each appliance.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
 - 5. List of maintenance parts.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

1.08 PROJECT CONDITIONS

Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

Not required.

1.11 RECORD DRAWINGS

Not required.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

- 2.01 <u>MATERIALS</u>
 - A. As indicated in the Drawings.
 - B. Or Owner approved equal.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Do not begin installation until substrates have been properly prepared. Coordinate rough-in with appliance sized and utility requirements.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Do not proceed until unsatisfactory conditions are corrected.

F. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

Assemble appliances and trim and install in accordance with manufacturer's instructions and the following:

- 1. Securely mount to substrate
- 2. Install appliances plumb and level and in proper relationship to adjacent construction.
- 3. Connect appliances to building utility, supply and waste systems as applicable.
- 4. Test for proper orientation and drainage. Adjust until proper operation is achieved.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.05 APPLIANCE DATA SHEETS

Refer to the manufacturer's data sheets as attached to this Section for required features and additional requirements.

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SECTION 12 20 00

WINDOW TREATMENT

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all Window Treatments, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section Includes: Manually-operated interior roller shades.

1.03 STANDARAD AND REFERENCES

- A. National Fire Protection Association (NFPA): www.nfpa.org:
 - 1. NFPA 701 Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
- B. Window Covering Manufacturers Association: www.access-board.gov:
 - 1. WCMA A 100.1 Safety of Corded Window Covering Products (ANSI)

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of 30 years' experience in manufacturing products comparable to those specified in this section.
- B. Installer Qualifications: Experienced Installer, trained and certified by manufacturer, who has completed at least five installations similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.
- C. Fire-Test response characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- D. Anti-Microbial Characteristics: "No Growth" per ASTM G 21, G 22, G 2180, results for fungi ATCC 9642, ATCC 9644, ATCC 9645, RITB 2101.
- E. Mockups: If architect requires, provide a mock-up of one roller shade assembly specified for evaluation of mounting, appearance and accessories.
 - 1. Locate mock-up in window designated by Architect.
 - 2. Do not proceed with remaining work until mock-up is accepted by architect.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop

Drawings and Samples.

- C. Qualification Data: For qualified roller shade fabricator and Installer.
- D. Product Certificates: For each type of shade material.
- E. Product Test Reports: For each type of shade material, certifying compliance with requirements.
- F. Product Data: For each type of (roller shades) product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
- G. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.
- H. Shop Drawings: For roller shades.
 - 1. Provide plans, elevations, sections, product details, installation details, operational clearances, and relationship to adjacent work.
 - 2. Locations and requirements for recesses and attachments to other work, including general construction, anchorage methods and locations, and service connections and locations.
 - 3. Include diagrams for power, signal, and control wiring including dimensioned connection locations.
 - 4. Indicate locations for fabric selections when more than one type is required.
- I. Samples for Verification: For each type of roller shade.
 - 1. Shade Material: Not less than 8"x10" sample.
 - 2. Roller Shade: Full-size operating unit, not less than 16 inches (400 mm) wide by 36 inches (900 mm) long for each type of roller shade indicated.
 - 3. Installation Accessories: Full-size unit, not less than 10 inches (250 mm) long.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Do not deliver window shades until building is enclosed and construction within spaces which require shades is substantially complete.
- D. Deliver products in manufacturer's unopened, original, undamaged containers with all labels intact.
- E. All containers and shades to be labeled according to Window Shade Schedule
- F. All products to be stored in manufacturer's unopened packaging until site is ready for installation.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work, including painting, is complete and ambient temperature and humidity conditions are maintained at levels indicated for Project when occupied for its intended use.

1.09 OPERATION AND MAINTENANCE DATA

- A. Provide in accordance with Project Manual Volume One, Article 6.12 Record Documents.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Provide in accordance with Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- D. For roller shades, to include in maintenance manuals.
 - 1. Methods for maintaining roller shades and finishes.
 - 2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.

1.10 EXTRA MATERIALS

Not required.

1.11 RECORD DRAWINGS

Not required.

1.12 WARRANTY

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Roller Shade Non-Electric Hardware: Manufacturer's standard non-depreciating twenty-five (25) year limited warranty. Chain to have manufacturer's standard, non-depreciating one (1) year limited warranty.
- E. Roller Shade Installation: One (1) year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.
- F. Roller Shade Fabric: Manufacturer's non-depreciating [ten] year limited warranty on fabrics installed on the interior. See Fabric Specification for specific fabric warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Roll-A-Shade, Inc.; 12101 Madera Way, Riverside, California, 92503 Telephone: (951) 245-5077; Fax (951) 245-5075 Email: Bids@rollashade.com, www.rollashade.com
- B. Or Architect approved equal.

2.2 ROLLER SHADE TYPES

- A. Manual operating interior, chain driven, roller shades in all windows of rooms and spaces indicated on the Drawings.
 - 1. Indicate Roller Shade Type: [RS-X]

2.3 ROLLER SHADE COMPONENTS

- A. Rollers: Extruded aluminum or corrosion-resistant aluminum tubes sized to accommodate roller operating mechanisms and specified Shades without deflection. Equip with permanently-lubricated drive-end and idle-end assemblies configured to allow removal of Shades for servicing.
 - 1. Direction of Shade Roll: Reverse, from interior face of roller.
 - 2. Shade-to-Roller Attachment: Manufacturer's standard method.
- B. Chain-and-Clutch Operating Mechanism: Continuous-loop bead chain and clutch that stops shade movement when bead chain is released; with upper and lower limit stops; permanently adjusted and lubricated.
 - 1. Bead Chains: #10 qualified stainless-steel chain rated to 90 lbs. (41 kg) minimum breaking strength. Nickel plated chain shall not be accepted.
 - a. Loop Length: Full length of roller shade.
 - b. Chain-Tensioner Type: Chain tensioner, sill mounted
 - 1) Color: As selected by Architect from manufacturer's full range.
- C. Mounting Hardware: Manufacturer's standard brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions.
 - 1. Bracket to be a minimum one sixteenth (1/16) in. (1.59mm) stamped steel, or heavier as required.
- D. Shade Bottom:
 - 1. Hem Bar: Extruded aluminum. Hem bar to be sealed on both ends using impulse welder.
 - 2. Roll-A-Shade Bottom Rail: As selected by Architect from manufacturer's full range.
- E. Installation Accessories:
 - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-Shaped
 - b. Height: Fabricator's standard height required to conceal roller and Shade assembly when shade is rolled up, but not less than 3 inches (76 mm).
 - c. Color: As selected by Architect from manufacturer's full range.
 - d. Indicate Roller Shade Type: [RS-X]
 - 2. Endcap Covers: To cover exposed endcaps.
 - a. Color: As selected by Architect from manufacturer's full range.
 - 3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 ROLLER WINDOW SHADE FABRIC

- A. Light Filtering Fabrics
 - 1. Style and Color as indicated in the Drawings.

2.5 ROLLER WINDOW SHADE UNIT FABRICATION

A. Roller Window Shade Unit Sizes: Fabricate units in sizes required to fill openings in configuration indicated:

- 1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of defined vertical separations between openings.
- B. Shade Fabrication: Fabricate Shades without battens or seams to extent possible, except for the following conditions:
 - 1. Railroaded Materials: Railroad material where material roll width is less than the required width of Shade and where indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roller window shade unit substrates with Installer for compliance with approved submittals and other conditions affecting performance of the Work.
- B. Proceed with installation once unsatisfactory conditions have been corrected.

3.2 <u>PREPARATION</u>

- A. Contractor shall clean Surfaces thoroughly prior to installation.
- B. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install roller window shade units level, plumb, square, and aligned with adjacent units according to fabricator's written instructions.
- B. Roller Window Shade Unit Locations: As indicated on Drawings.
- C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding, tracking or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller window shade unit surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions that ensure that roller window shade units are without damage at time of Substantial Completion.
- C. Protect installed products until completion of project.
- D. Replace damaged roller window shade units that cannot be repaired, before time of Substantial Completion.

3.5 TRAINING

- A. Engage a manufacturer-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain manual roller shaded systems.
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller window shade units.

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SECTION 12 93 14

BICYCLE STORAGE

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK

Supply and install all bicycle storage lockers, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete and proper installation.

1.03 STANDARDS AND REFERENCES

- A. ASTM A314 Standard Specification for Stainless Steel Billets and Bars for Forging
- B. ASTM A591 Standard Specification for Steel Sheet, Electolytic Zinc Coated, for Light Coating Mass Applications.
- C. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profile and Tubes.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing site furnishing products similar to those required for this project and with a record of successful in-service performance.
- B. Installer Qualifications: An experienced installer who has completed installation of bicycle lockers similar in material, design and extent to that indicated for this project and whose work has resulted in construction with a record of successful in-service performance.
- C. Source Limitations: Obtain each color, finish and type of bicycle locker from a single source with resources to provide components of consistent quality in appearance and physical properties.
- D. Product Options: Drawings indicate size, shape and dimensional requirements of bicycle lockers and are based on the specific system indicated.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Product Data: Manufacturer's data sheets on each product to be used, including
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.

- 3. Installation methods.
- D. Shop Drawings: Show assembly and installation details. Include physical characteristics such as shape, dimensions, bicycle parking capacity and finish.
- E. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- F. Verification Samples: For each finish product specified, two samples, minimum size 2 inches (52mm) square, representing actual product, color and patterns.
- G. Maintenance Data: Include recommended methods for repairing damage to the powder coat finish.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.
- C. Deliver materials to the site in an undamaged condition. Carefully store materials to provide proper protection against damage from moisture, heat, cold, direct sunlight or other causes.
- D. Store products in manufacturer's unopened packaging until ready for installation.
- E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 PROJECT CONDITIONS

A. Do not use products under conditions of precipitation, or in inclement or freezing weather. Verify that substrates are clean, dry and frost-free. Use appropriate measures for protection and supplementary heating to ensure proper curing conditions per manufacturer's recommendations if application during inclement weather occurs.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

Not required.

1.11 RECORD DRAWINGS

Not required.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 <u>MANUFACTURERS</u>

- A. Basis of Design: Dura Bike Locker Co. (a subsidiary of Hannan Specialties Inc.), 3790 Bradview Drive, Sacramento, CA 95827. Phone (800) 722-2453, Fax (916) 363-0225. Website: www.durabikelockers.com. Email: info@durabikelocker.com
- B. Acceptable Alternates: Huntco Site Furnishings, American Bicycle Security Company, or Architect approved equal.

2.02 BICYCLE STORAGE

- A. Bicycle Lockers
 - 1. Basis of Design: Model DL1, single unit, with fixed back panel.
 - 2. Material: G-90 galvanized steel bicycle locker
 - 3. Dimensions: 30 inches wide by 75 inches long by 48 inches high.
 - 4. Door Type: Universal Solid Door
 - 5. Wall Type: Solid Wall
 - 6. Lock Type: Pad Lock Handle
 - 7. Finish: Powder Coat, color: Standard to be selected.
- B. Bicycle Rack:
 - 1. Basis of Design: Model DBRP-3-IG-P, Surface mounted hoop style
 - 2. Material: Schedule 40 pipe (2 3/8" OD) bicycle rack
 - 3. Dimensions: 22 inches wide by 36-1/2" high.
 - 4. Finish: Powder Coat, color: Standard to be selected.
 - 5. Rack Accessories: Lean Bar with Security Cables (SC)
- C. Galvanized Steel Fabrication:
 - 1. Exterior Walls, Tops, Back Panels and Doors (ASTM A591): 16 gauge (1.613 mm) galvanized steel. Doors shall have a 16 gauge (1.613 mm) galvanized steel horizontal stiffener for additional rigidity.
 - 2. Frames (ASTM A591): 14 gauge (1.897 mm) CRS. All frame panels shall have 6 punched-in louvered vents.
 - 3. Full length door hinge (ASTM A314): 16 gauge (1.613 mm) stainless steel.
 - 4. 3-Point Locking Bar Mechanism (ASTM A314): 1 inch wide by 1/4 inch thick (25.4 mm by 6.4 mm) stainless steel flat bar running beyond the full length of the door frame and into the top, threshold, and jamb (3-Points to insure Maximum Security).
 - 5. Fasteners shall be zinc coated steel and shall be fastened from the inside.
 - 6. Standard finish: (TGIC) Powder Coated.
 - a. Color: Standard color to be determined.
 - b. Optional colors available upon request and Anti-Graffiti at an additional cost.
- D. Locking:
 - 1. Heavy-duty, pop-out "T" Handle #4266 with two user keys. Keyed to match building key system.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

A. Clean the location thoroughly prior to the installation process. Prepare all surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with the manufacturer's instructions.
- B. Locate where shown on the Drawings. Assemble and anchor in accordance with the manufacturer's instructions.
- C. Set bicycle lockers and racks secured to construction, level and true to line, in correct relationship to adjacent structure and improvements.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair, or replace damaged products before substantial completion.
SECTION 21 00 00

WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Furnish all tools, labor, materials and equipment and perform all operations in connection with the Fire Protection Work, complete as indicated and specified.
- B. Work Included:
 - 1. General requirements, general materials, equipment and installation shall be as herein after specified in Mechanical Scope and General Requirements and Materials and Installation, insofar as same are applicable to the work of this Section.
 - 2. The fire service and automatic fire sprinkler system minimally consists of detector check meters, piping, valves, alarm valve assemblies, fire sprinkler heads, fire department connections, hangers, sway bracing and other equipment herein specified.
 - 3. Materials, equipment and installation, as specified in this Section for the Fire Protection System, shall take precedence over that elsewhere specified.
 - 4. This specification represents the County's/Client's minimum requirements for a complete, proper, approved and operating Fire Protection System. Contractor shall be responsible for a design-build Fire Protection System including compliance with all applicable codes and requirements of the agency having jurisdiction (Imperial County Fire Department). Contractor to create required drawings and submit to the agency having jurisdiction for plan check and approval and shall acquire a permit and perform all installation, coordination, inspections and testing, as well as provide all materials and services necessary for a complete, approved and operational Fire Protection System.
 - 5. Other materials, equipment and installation shall be as herein specified.
 - 6. The automatic fire sprinkler system shall be designed and installed complying with NFPA 13 occupancy requirements. Nothing in these Specifications is to be construed to permit work in violation of the Standard.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

A. Project Manual Volume One, Sections 00710, Article 6.05 – Substitutes and "Or-Equals".

B. Project Manual Volume One, Sections 00800, SC-6.05 - Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.

1.07 DELIVERY, STORAGE AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATING AND MAINTENANCE INSTRUCTIONS

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Article 6.12 Record Documents.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Provide in accordance with Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- D. Three (3) copies of operating and maintenance manuals for systems specified in this Section shall be delivered to the Owner.
- E. The Contractor shall instruct the Owner's Representative who will operate the system, about the operation and maintenance of the equipment.
- F. An affidavit by the Owner's Representative certifying that the above requirements have been complied with shall be submitted to the Architect.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT OF EQUAL MANUFACTURER

- A. In addition to manufacturers specified, the following shall also be considered equal, provided corresponding models meet specification requirements. The equivalent equipment names shall be submitted to the Architect for approval.
 - 1. Detector Check: Hersey.
 - 2. Valves: Mueller, Stockham, Kennedy, Nibco, Jenkins.
 - 3. Fire Dept. Connections: Potter-Roemer, Grinnell, and Sierra.
 - 4. Alarm Valve Assemblies: Grinnell, Viking, Globe.
 - 5. Pressure Gauges: Potter-Roemer, Grinnell.
 - 6. Access Boxes: Brooks, Christy.
 - 7. Sprinkler Heads: FlexHead (800) 829-6975.
 - 8. Pipe Markers: Brady, Standard.
 - 9. Tamper Switch: Potter-Roemer.
 - 10. Flow Switches: Potter-Roemer.

2.02 MATERIALS

- A. Piping:
 - In Building: Schedule 40 black pipe with 125# black banded cast iron screwed fittings and couplings. At Contractor's option, piping may be Schedule 40 black steel grooved pipe with Victaulic U.L. listed black grooved fittings and Victaulic No 77 U.L. listed malleable iron couplings with Grade H white gasket. Thin wall steel piping shall not be used.
 - Outside Building Below Ground: PVC (polyvinyl chloride pipe), Type I, Grade Class 315, SDR 14, 2DD psi working pressure at 73 degrees F meeting ASTM D2241. Pipe shall be U.L. and State Fire Marshal approved and installed in accordance with AWWA C900 PVC plastic fittings and couplings.
- B. Pipe Hangers, Supports and Attachments:
 - 1. Pipe Hangers: U.L. listed complying with N.F.P.A. Standard No.13.
 - 2. Pipe Sway Bracing: Complying with N.F.P.A. Standard No.13.
 - 3. Powder actuated tools shall not be used.
 - 4. Steel construction fireproofing damaged by the pipe hanger attachment installation shall be repaired as approved by the Architect.
- C. Valves:
 - 1. Building Installed Shut-Off Valves: Mueller A-2073-6, 17511-flanged I.B.B.M., U.L listed gate valve with double disc and O.S.&Y.
 - 2. Post Indicator Valves:
 - a. Valve: Mueller A-2052-6, 175# flanged I.B.B.M., U.L. listed gate valve with double disc, inside screw, N.R.S. and indicator post flanged.
 - b. Post Indicator: Mueller A-20801 U.L. listed assembly with cast iron body, telescopic barrel with bottom flanged for bolting to valve indicator post flange, locking device and operating wrench; assembly shall be painted in accordance with the requirements of the Fire Department.

- 3. Check Valves: Mueller A-212D-6, 175# flanged I.B.B.M., U.L. listed valve with bolted bonnet. Wafer type check valve shall not be used.
- 4. Globe Valves: Nibco T-211-Y, 200# W.O.G. screwed all bronze valves with screwed bonnet and renewable Teflon disc.
- 5. Angle Valves: Nibco T-311-Y, 200# W.D.G. screwed all bronze valves with screwed bonnet and renewable Teflon disc.
- 6. Detector Check Assembly: Hersey Model DDC 11 unit with automatic lever check valves, 3/4" by-pass disc meter and two I.B.B.M., O.S. & Y. flanged gate valves, the entire assembly shall be U.L. listed.
- 7. Concrete Vault:
 - a. Brooks 900 Series size as indicated on the drawings, open bottom vault with 6" thick walls assembled at the site. Asphalt coated inside and out.
 - b. Rebar sizes and arrangement shall be as indicated on Brooks Drawing 900-673.
 - c. Knockouts shall be provided as required for the piping installation.
 - d. Top of vault shall be provided with galvanized armor to receive 3/8" thick galvanized floor plate; floor plate shall be furnished in three sections, shall be provided with lift holes and shall be bolted down.
 - e. Vault shall be set with finished gate.
- D. Fire Department Connections:
 - 1. Potter-Roemer No.5763 UL Listed cast brass body with drop clappers unit with two (2) 2-112" inlets and one (1) 6" outlet and two (2) chained brass pin plugs. Polished brass plate with the letters "AUTO SPRINKLER" in it. Overall height 24".
- E. Alarm Valve Assembly: Potter-Roemer No.6200 Series tamper proof switch. Housing with flow paddle.
- F. Accessories:
 - 1. Pressure Gauges: Potter-Roemer No.6240, U.L. listed gauge with 3-1/2" diameter polished brass case and glass protected dial with 0 psi. to 300 psi. pressure range.
 - 2. Access Boxes: Brooks No. 3-RT open bottom concrete box with cast iron frame and cover with the word "SPRINKLERS" cast in cover.
- G. Fire Sprinkler Heads:
 - 1. FlexHead U.L. listed fusible link type heads with 165 degrees F. ordinary rating, unless otherwise required by the Fire Department or authorities having jurisdiction.
 - 2. Rooms with Finished Ceilings: "Duraspeed" recessed plate pendent head; both head and plate furnished in plain finish.
 - 3. Attic: "Duraspeed" pendent and upright heads furnished in plain finish.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the Work.
- C. Do not proceed until unsatisfactory conditions are corrected.

D. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

- A. The Contractor shall do all necessary excavation, shoring and backfilling required for the proper installation of buried pipelines and related material and equipment.
- B. The Contractor shall maintain temporary barricades, warning lights, covers, railings and other protection or warning devices while the trenches are open.
- C. Piping installation and trench backfilling shall be done promptly after the trenching has been completed in order to keep the trenches open as short a time as possible; however, no backfilling will be permitted until the piping installation has been reviewed by the Fire Department for compliance with the Contract Documents. Piping shall be buried below the freezing line.
- D. Upon completion of the work, the Contractor shall remove from the premises all surplus material, rubbish and debris resulting from his operation. The premises shall be left in a clean and neat condition.
- E. Pipelines shall be constructed of full-length sections of specified pipe except where length of run is less than full pipe length.
- F. Unless otherwise indicated or required, piping shall be concealed in finished portions of the buildings.
- G. Unless otherwise hereinafter specified, polished chrome plated cast brass hinged split flanged escutcheons with setscrew shall be provided at all points where pipes pierce finished surfaces.
- H. Unless specifically approved by the Architect, piping shall clear beams, columns, and other structural members.
- I. Pipe size reductions shall be made with reducing fittings. Unless specifically approved by the Architect, bushings shall not be used.
- J. Welding saddles may be used for branch pipes two pipe sizes smaller than main pipe; however, for cross configuration, welding saddles may be used for branch pipes three pipe sizes smaller than main pipe.
- K. Close nipples and street elbows shall not be used.
- L. A certified welder shall perform pipe welding; a laboratory approved by the Architect shall issue certificate.
- M. Fire sprinkler heads shall be located in straight lines parallel to the walls.
- N. Fire sprinkler heads shall be located not less than 12 inches from the ceiling T-Bars
- O. Concrete paving shall be cut with saw; concrete walls and floors shall be cored.
- P. Underground piping shall be installed as follows:
 - 1. Trenches shall be not less than 12 inches wider than the greatest diameter of the pipe.
 - Bottom of the trenches, 36" minimum, shall be excavated to a depth of three inches (3") below the bottom of the piping, and the space shall be filled with three inch (3") deep layer of clean sand which shall be well tamped.
 - 3. Upon installation of the piping, the pipe shall be covered with three-inch (3") deep layer of clean sand, which shall be well tamped.
 - 4. Should it be required to lay pipe on fill, the fill shall be first compacted as specified in Section 31 23 00.

- Q. Trench backfilling shall be done as required by Section 31 23 00.
- R. Clamps and/or concrete thrust blocks shall be provided at dead ends, bends, tees or other points where separation and/or change of direction might occur in cast iron piping, or polyvinyl chloride piping. Thrust block sizes shall be sized, using Manville "Transite Ring-Tite" Pressure Pipe Installation Guide Book for Class 150 pipe, 200 psi. pressure and 2,000-lb./sq. ft. soil bearing capacity.
- S. Buried valves shall be anchored with two 5/8" inverted U-type bent anchor rods imbedded in concrete
- T. Flanged connections below ground shall be made with stainless steel bolts, nuts and washers.
- U. Access boxes shall be set flush with finished grade.
- V. Main piping shall be flushed in compliance with N.F.P.A. Standard No.24.
- W. Pipe flushing and test shall be witnessed by the Fire Department.
- X. The Fire Department shall be notified forty-eight (48) hours prior to the schedule flushing and testing.
- Y. Shop drawings of the entire automatic fire sprinkler system approved by the Fire Department shall be submitted to the Architect for review prior to the Start of Construction; after the Architect's Review, the shop drawings shall be submitted for approval to the State Fire Marshal. The approved shop drawings shall become an integral part of the Contract Document.
- Z. Prior to preparation of the shop drawings, the Contractor shall coordinate his work with work of other sections especially the ductwork and lighting.

AA. The Contractor shall deliver to the Architect record drawings as specified in Section 01 77 00.

3.03 **<u>PIPING IDENTIFICATION</u>**

- A. All exposed piping and all piping above the T-Bar ceiling shall be identified with Brady B-500 vinyl cloth pressure sensitive markers secured in place with 3/4" wide vinyl cloth pressure sensitive tape wrapped around the pipe one complete turn.
- B. Pipe markers shall be applied to a dry and clean surface.
- C. Pipe markers shall have the words "FIRE SPRINKLER" with white letters on red background.
- D. Pipe markers shall be provided not more than three feet (3') from the following:
 - 1. Tee (all three sides)
 - 2. Wall
- E. Pipe markers shall be spaced not more than fifteen feet (15') apart measured along the pipe run.
- F. Flow direction arrows of the same material and color, as the pipe markers shall be provided downstream of and adjacent to all pipe markers.
- G. Pipe markers shall be readily visible to a person standing on the floor in normal access space to the piping.

3.04 <u>TEST</u>

Piping shall be tested hydrostatically under 200 psi. pressure for not less than two (2) hours.

END OF SECTION

SECTION 22 00 10

BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.
- C. Basic Plumbing Requirements specifically applicable to Division 22 Sections, in addition to Division 01 General Requirements.

1.02 SCOPE OF WORK SUMMARY

- A. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified and as required to complete the work of this section, except as otherwise herein specifically excluded.
- B. The complete Plumbing systems (including Fire Protection systems), including but not limited to these major items:
 - 1. Coordinate work of this Section with related trades.
 - 2. Verify applicable dimensions at the jobsite.
 - 3. Furnishing and installation of miscellaneous hangers, supports, sleeves, inserts, anchors and other auxiliary equipment for systems under this Division.
 - 4. Soil waste and vent system inside and outside the building including connections to fixtures, equipment, sewer connections, and clean-outs.
 - 5. Water piping systems inside and outside the building, including connections to fixtures, equipment, water meters and vaults; pressure regulating stations, backflow preventers.
 - 6. Interruptible and non-interruptible fuel gas systems inside and outside the building, including connections, gas meters, earthquake valves, and pressure regulating stations.
 - 7. Plumbing fixtures, carriers, fittings, trim, hose bibs, wall hydrants, and accessories.
 - 8. Installation and connection of Owner furnished equipment.
 - 9. Natural gas piping system including connections to equipment and site.
 - 10. Water heating systems, including water heating equipment, circulating pumps, connections.
 - 11. Shop drawings.
 - 12. Equipment identification.
 - 13. Equipment and systems adjustments and balancing.
 - 14. Air, water and gas systems testing, adjusting and balancing.
 - 15. Written operating and maintenance instructions.
 - 16. Record drawings.
 - 17. Warranty.

1.03 STANDARDS AND REFERENCES

- A. Specification Section 230801 Commissioning of Building Systems.
- B. Comply with the Industry Standards and References as established by Manufacturers.

1.04 ORDINANCES, REGULATIONS AND CODES

- A. References to Technical Societies, Trade Organizations, Governmental Agencies is made in in accordance with the following abbreviations.
 - 1. AFI Air Filter Institute
 - 2. AMCA Air Moving & Conditioning Association
 - 3. ARI Air Conditioning & Refrigeration Institute
 - 4. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
 - 5. ASME American Society of Mechanical Engineers
 - 6. ASTM American Society of Testing Materials
 - 7. AWSC American Welding Society Code
 - 8. ANSI American National Standards Institute
 - 9. CBC California Building Code
 - 10. CCR California Code of Regulations
 - 11. CEC California Electrical Code
 - 12. CFC California Fire Codes
 - 13. CMC California Mechanical Code
 - 14. CPC California Plumbing Code
 - 15. FIA Factory Insurance Association
 - 16. NAFM National Association of Fan Manufacturers
 - 17. NEMA National Electrical Manufacturer's Association
 - 18. NFPA National Fire Protection Association
 - 19. ORS Office of Regulatory Services
 - 20. SCAQMD South Coast Air Quality Management District
 - 21. SMACNA Sheet Metal and Air Conditioning Contractors National Association
 - 22. UFC Uniform Fire Code
 - 23. UL Underwriter's Laboratories
 - 24. UPC Uniform Plumbing Code
- B. Requirements of Regulatory Agencies: Materials and installation shall comply with applicable local, state, and national codes and ordinances. Rulings and interpretations of the enforcing agencies shall be considered as part of the local codes. No extras will be permitted for furnishing items required by the local codes but not specified or shown on the drawings.
- C. Codes and Standards:
 - 1. IBC and California Amendments (California Building Code Part 2, Title 24, CCR).
 - 2. UMC and California Amendments (California Mechanical Code Part 4, Title 24 CCR).

- 3. UPC and California Amendments (California Plumbing Code Part 5, Title 24 CCR).
- 4. Uniform Fire Code with State Amendments (California Fire Code Part 9, Title 24 CCR).
- 5. National Fire Protection Associations National Fire Code.
- D. Nothing in these drawings and specifications is to be construed to permit work in violation thereof. Ordinances, regulations and codes are to be construed as minimum requirements.
- E. The responsibility of the Architect to conduct construction reviews of the Contractor's performance is not intended to include the adequacy of the Contractor's safety measures in, on, or near the construction site.
- F. Ventilating, refrigeration and electrical equipment and appliances are required to be approved by the Underwriters' Laboratories, Inc., or other nationally recognized testing agency and installed per the testing agency's specifications.

1.05 QUALITY OF EQUIPMENT, MATERIALS AND WORKMANSHIP

Unless otherwise specified, equipment and materials used in the installation shall be new and in perfect condition when installed. Articles provided for the same general purpose or use shall be of the same make. Workmanship shall be of the best quality and none but competent mechanics skilled in their trades shall be employed. Furnish the services of an experienced superintendent, who shall be constantly in charge of the work, together with all necessary journeymen, helpers and laborers required.

1.06 DRAWINGS AND SPECIFICATIONS

- A. The Architect's decision will be final on interpretation of the Drawings and Specifications.
- B. The Drawings and Specifications are complimentary. Any work called for on the Drawings and not mentioned in the Specifications, or vice versa, shall be performed as though fully set forth in both.
- C. Piping, ductwork and other equipment shown as existing has been taken from the Owner's drawings. Contractor shall verify exact location in field before proceeding with the work.
- D. Where codes, standards, drawings or specifications conflict, the most stringent shall prevail, unless prior approval for variance is obtained. Specific details on the drawings shall supersede the specification in the event of a conflict.
- E. Alternate support or seismic detail shall have prior approval by the Architect; and the Contractor shall obtain agency approval without any additional cost or time to the contract.

1.07 SUBSTITUTIONS

- A. Substitutions will be considered per:
 - 1. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
 - 2. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".
- B. It is the intent of the Owner to have this project constructed with materials, products and system originally designed and specified into the project.
- C. The design has been based on data from certain manufacturers, suitable for each application. Recommendations for alternative manufacturers are made for each product, except when "no substitutions permitted" is indicated.
- D. Alternatives that may require the modification, realignment and/or adjustment of other associated components, including impact on other trades, shall be accomplished at no additional cost or time to the contract and shall have the approval of the Architect.

E. Substitutions shall be submitted addressing all features listed in the specifications. Features that deviate from the plans and specifications shall be clearly identified including justification for deviations. Design West Engineers will review initial submittal on substitutes only. Subsequent submittals made to correct deficiencies in original submittals will be reviewed at Contractor's expense based on Design West Engineer's hourly rate for engineering services.

1.08 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Before starting work, the Contractor shall furnish for the approval of the Architect, Shop Drawings and Submittals with Itemized Equipment Lists, complete in all details that they proposes to install. All items shall be submitted at the same time.
- C. Submittals must be specific to this project with respect to model number, capacities, performance, etc., generic submittals will not be accepted.
- D. Variations or deviations on submitted items from that specified must be clearly tagged and / or identified
- E. Submittals shall include, but not necessarily be limited to the following which are mandatory:
 - 1. Draw Equipment Layouts to ¼" scale, including equipment, piping accessories, and showing clearances for operating and servicing.
 - 2. Schedule of pipe, fittings, valves, with manufacturer and catalog number.
 - 3. Specialties, valves, gauges and thermometers of all types.
 - 4. Foundations, supports, hangers, inserts.
 - 5. Earthquake supports and calculations.
 - 6. Insulation.
 - 7. Shop fabrication drawings and installation drawings of ductwork and piping layouts. Submit for approval prior to fabrication. Drawings shall indicate dimensions from bottom of piping and ductwork to finish floor level.
 - 8. Wiring diagrams, control panel board, motor starters and controls for electrically operated equipment furnished by mechanical trades.
 - 9. Access panels.
 - 10. Clean-outs
 - 11. Fixture carriers.
 - 12. Hangers, inserts, supports, anchors.
 - 13. Hose bibs.
 - 14. Hot water circulators.
 - 15. Pipe, fittings and specialties.
 - 16. Pipe isolators.
 - 17. Plumbing fixtures, fittings, trim, drains and receptors.
 - 18. Pressure regulators.
 - 19. Roof flashing.

- 20. Sleeves, escutcheons, caulking, waterproofing, fireproofing.
- 21. Strainers
- 22. Water hammer arrestors.
- 23. Water heating equipment.
- 24. Expansion joints, guides and anchors.
- 25. Shop fabrications drawings and calculations.
- 26. Special and miscellaneous products furnished under this section and not listed herein.

1.09 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.10 OPERATION AND MAINTENANCE DATA

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Article 6.12 Record Documents.
 - 2. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents.
 - 3. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- B. Manuals:
 - 1. Obtain data from the various manufacturers and submit instruction, operation, and maintenance manuals as required and to the extent required under other Sections.
 - 2. Unless otherwise specified, each submittal shall include two copies of each manual, one of which will be returned to the Contractor, marked to show the required review. When approved, deliver four copies to Architect unless otherwise specified.
- C. Contents: Each manual shall have an index listing the contents. Information in the manuals shall include not less than:
 - 1. General introductions and overall equipment description, purpose, functions and simplified theory of operation.
 - 2. Specifications
 - 3. Installation instructions, procedures, sequences, and precautions, including tolerances for level, horizontal and vertical alignment.
 - 4. Grouting requirements.
 - 5. List showing lubricants for each item of mechanical equipment and recommended lubrication intervals.
 - 6. Start-up and beginning operation procedures.
 - 7. Operational procedures.
 - 8. Shutdown procedures.
 - 9. Maintenance and calibration procedures
 - 10. Parts lists

11. Name, address and telephone number of each manufacturer's local representative.

1.11 RECORD DRAWINGS AND MANUALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
 - 2. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
 - 3. Project Manual Volume Four, Section 01 78 39 Project Record Documents.
- B. Record Set During the Work: At site, maintain at least one set of Drawings as a Field Record Set. Also maintain at least one copy of all Addenda, Modifications, approved submittals, correspondence, and transmittals at site. Keep Drawings and data in good order and readily available to Architect and Owner.
- C. Changes: Clearly and correctly mark Record Drawings to show changes made during the construction process at the time the changed work is installed. No such changes shall be made in the work unless authorized by the Architect.
- D. Final Record Drawings: Conform to Volume 1 and Volume 2 requirements.
- E. Preparation of Final Record Drawings: Contractor shall transfer recorded changes in the work indicated on the Field Record Set to the record set. Changes shall be neatly and clearly drawn and noted by skilled draftsmen, and shown technically correct.
- F. Approval: Prior to Architect's inspection for Substantial Completion, submit the Final Record Drawings to the Architect for review, and make such revisions as may be necessary for Final Record Drawings to be a true, complete, and accurate record of the work.
- G. "As-Built" drawings of ductwork and piping, including all elbows, transitions, damper and valve locations shall be provided prior to commencement of air and water balance.

1.12 WARRANTY

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
 - 2. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- B. Contractor shall guarantee workmanship, equipment and materials installed under his contract for a minimum period of not less than one (1) year from the date of Substantial Completion. Should any defects occur during this period, the Contractor shall promptly repair or replace the defective item and any other damage caused to the building free of charge to the Owner, including cost of labor and materials.
- C. Guarantee included in this section to cover:
 - 1. Faulty or inadequate design of equipment or material installed
 - 2. Improper assembly or erection
 - 3. Defective workmanship or material
 - 4. Incorrect or inadequate operation or other failure
- D. He shall guarantee the complete and perfect operation of the entire system and that equipment will be supported in such a way as to be free of objectionable vibration and noise
- E. Furnish the parts and labor to replace any items found to be defective in the refrigeration equipment with the guarantee period

- F. In addition to other guarantees, furnish free maintenance for the refrigeration equipment, including replacement of refrigerant and oil, for a period of one (1) year. This shall include regular monthly maintenance and "On Call" service if required.
- G. For equipment bearing a manufacturer's warranty in excess of one year, furnish a copy of the warranty to the Owner, who shall be named as beneficiary.

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 SITE INSPECTION

Contractor shall familiarize himself with the conditions at the site. No allowance will be made subsequently for any error through negligence in observing the site conditions. Contractor shall observe and make cost allowance for any mechanical and/or electrical items that must be relocated to accommodate the installation or servicing of any item covered under this contract.

3.02 SEISMIC DESIGN

Contractor shall be responsible for anchors and connections of mechanical work to the building structure including calculations for approval by structural engineer or for approval by inspector of record, as applies, for items or work, where approval is deferred or where alternate support or anchorage detail is proposed to prevent damage as a result of an earthquake, including manufactured equipment, the connection and integrity of shop fabricated and field fabricated materials and equipment. The anchorage of all pipes, ducts, conduits, fixtures, equipment, etc. shall withstand the lateral forces and shall accommodate calculated building displacement as required by the California Building Code, and local city/county codes. (Building equipment and connections therefore shall be designed to resist lateral seismic forces equal to 1.0 of equipment weight to working allowable stress. Cantilever posts supporting equipment shall be designed to resist lateral seismic forces equal to 0.5 of equipment weight to allowable working stress. Conform to the following:

- 1. In accordance with Title 24, 2016 CBC Chapter 16A, details shall be provided for the seismic anchorage of all mechanical and electrical equipment, anchorage details shall be based upon appropriate design calculations.
- 2. For equipment weighing 400 pounds or more anchorage details and appropriate design calculations shall be submitted as part of the mechanical and electrical drawings. "Deferred Approval" items will not be permitted unless specifically approved by the plan check supervisor.

Exception: Attachments of equipment weighting less than 400 pounds and supported directly on the floor or roof structure, furniture, or temporary or movable equipment and equipment weighing less than 20 pounds that is supported by vibration isolation devices suspended from the roof, wall or floor, need not be detailed on the plans provided the following notes are included on the mechanical and electrical plans.

3. The seismic anchorage of mechanical and electrical equipment shall conform to C.C.R. Title 24, 2016 CBC Chapter 16A. Anchorage details for roof/floor-mounted equipment shall be shown on plans.

3.03 APPROVALS

The Architect will have the right to accept or reject equipment, materials, workmanship, tests and determine when the Contractor has complied with the requirements herein specified.

3.04 LOCATIONS AND ACCESSIBILITY

- A. Drawings show pipe and ductwork diagrammatically. Conform to Drawings as closely as possible in layout work. Vary run of piping, run and shape of ductwork and make offsets during progress of work as required to meet structural and other interferences as approved by Architect. Install piping and ductwork to best suit field conditions after coordinating with other trades. Run exposed piping and ductwork parallel to, or at right angle to, building walls. Keep horizontal lines as close to bottom of structures as possible. Conform to ceiling heights established on Drawings.
- B. Install equipment in such a manner as to be readily accessible for maintenance and repairs. Install piping, ducts and conduit in such a manner as to preserve headroom, avoid obstructions and keep openings and passageways clear.
- C. Installation at valves, thermometers, gauges, cleanouts, dampers, controls, steam and water specialties, duct access doors or any other indicating equipment or specialties requiring reading, adjustment, inspection, and maintenance shall be conveniently and accessible located with reference to the finished building.
- D. Where wall and ceiling access doors are required but not shown, such doors shall be furnished under other sections and as directed by the Architect. Coordinate this requirement with appropriate trade.
- E. If changes in the indicated locations or arrangements are required, they shall be made without additional charges.
- F. In an existing area, where required, remove, reinstall, reconnect or replace, etc., any existing work to accommodate new work without any additional cost to the Owner. Material shall match existing, unless otherwise specified or approved in writing by the Architect.
- G. Provide sheaves and belts if required, to Test, Adjust and Balance Agency, to allow air moving equipment to meet flow requirements specified at no additional cost to the Owner.

3.05 COORDINATION OF TRADES

- A. Contractor shall coordinate all trades in the interest of obtaining the most practical overall arrangement of equipment, piping, conduit, and ducts and to maintain maximum headroom and accessibility.
- B. No extras will be allowed for changes made necessary by interference between trades.
- C. Submit Composite Drawings in accordance with Special Conditions. Include dimensioned plans, elevations, sections and details and give complete information particularly as to the kinds and types of materials and equipment, size and location of sleeves, inserts, attachments, chases, openings, conduits, ducts, boxes, lighting, structural interferences. Coordinate these Composite Drawings and field layouts in the field for proper relationship to work of applicable trades based on field conditions. Contractor shall have competent personnel readily available for coordinating, checking, and supervision of field layouts. The procedures for submittals and resubmittals, and final distribution shall be as specified in Division 01. Do not start installation of work involved under Composite Drawings until the Architect reviews applicable submittal. Discrepancies between the Drawings and Composite Drawings shall be specifically noted and identified on the Composite Drawings. Drawings for the various trades involved shall be submitted as required and reviewed prior to preparation of Composite Drawings.
 - 1. Equipment Foundations and Bases: Furnish certified details and drawings for approval before fabrication. Furnish parts necessary for each foundation sub base and support.
 - 2. Pipe Sleeves and Inserts: Furnish and install pipe sleeves and pipe support inserts before concrete is poured.

- 3. Roof, Wall and Floor Openings: Furnish Shop Drawings showing exact locations and sizes of openings through roofs, walls and floors.
- 4. Concrete: Conform to Concrete Section of the Specifications.

3.06 PROTECTION OF EQUIPMENT AND MATERIALS

Provide adequate storage facilities for equipment and materials on the site and shall make provisions to protect such materials and equipment from damage.

3.07 CLOSING-IN OF UNINSPECTED WORK

Contractor shall not allow or cause any of the work, specifically ductwork and piping, to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Should any of work be covered up or enclosed before such inspection and test, shall at their own expense, uncover the work and after it has been inspected, tested, and approved, make repairs with such materials as may be necessary to restore work to its original and proper condition.

3.08 BUILDING FOOTING CLEARANCES

Under no circumstances shall pipes, ducts, or conduits penetrate footings. They shall cross below footings or through sleeves above footings. Those running parallel to footings shall have the minimum clearance from the cone of influence indicated on the Drawings or as required by Code.

3.09 DAMAGE BY LEAKS

Contractor shall be responsible for all damage to any part of the premises caused by rain leaks through or around ducts or pipes, leaks or breaks in piping, equipment or fixtures furnished or installed by him for a period of one (1) year from the date of Substantial Completion.

3.10 EQUIPMENT LABELS

Equipment provided under this Section shall be provided with the manufacturer's metal identification labels attached to each individual piece of equipment showing complete performance characteristics, size, model and serial number.

3.11 EXCAVATION, TRENCHING AND BACKFILLING

- A. Excavating, trenching and backfilling for utilities within the building area shall be done in conformity with Sitework requirements. Piping shall be installed promptly after excavation in order to keep the trenches open as short a time as possible.
- B. Excavating, trenching and backfilling for utilities outside the building area shall be done in conformity with Sitework requirements.
- C. Any existing underground piping and conduit that is encountered shall be properly shored and protected from damage. Active piping shall be left intact and undamaged.

3.12 PRELIMINARY OPERATION

Should the Owner request that any portion of the plant, apparatus, or equipment be operated for the Owner's beneficial use prior to the final completion and acceptance of the work, the Contractor shall conform to Beneficial Occupancy Provisions of the General Conditions. Such operation shall be under the supervision and direction of the Contractor. Such preliminary operation shall not be construed as an acceptance of any of the work.

3.13 MAINTAINING EXISTING SERVICES

A. The premises and existing building at the site will be in use at the time the work of this Section is in progress. Contractor shall conduct his work so as to cause no inconvenience or danger to the personnel on the premises.

- B. He shall maintain continuity of service to the existing mechanical systems, except for designated intervals during which connections can be made. The scheduling of the shutdown period shall be at a time directed by the Architect.
- C. In some instances, it may be necessary to defer work in certain areas and locations until such time as existing facilities can be relocated or rearranged by the Owner. Therefore, whenever it becomes necessary for the Contractor to perform work under this contract in areas in which the Owner's work is being performed. This contractor shall advise the Architect relative to this requirement and shall follow closely the directive issued by the Architect insofar as time and procedure are concerned. Allow Owner 72 hours prior notice.
- D. This contractor shall include in his bid all premium time to which he may be subjected for performing work in such procedure and at such time as may be necessary to cause the least interference with the function of the Owner.

3.14 ELECTRICAL WORK

- A. Coordinate with Division 26 in making the line and low voltage electrical connections and be responsible for the operation of the equipment furnished under this section.
- B. Voltage for electrical work will be included in Division 26. However, any control wiring which is required that is not shown on the control diagram shall be as described under this Section. In the event that the Contractor chooses to provide equipment that requires extra expense in the power or control wiring, he shall pay additional electrical costs.
- C. Safety switches, starters, circuit breakers, unless provided as a portion of package equipment, and the electrical connections of mechanical equipment to the electrical power service shall be provided under Division 26.
- D. Interconnecting wiring, safety switches, relays, controllers and motor starters which are integral components of packaged equipment shall be provided as an integral part of that equipment.
- E. All interconnecting power wiring and conduits shall be provided by Division 26.
- F. Control wiring shall be provided by Division 22, unless otherwise indicated on the drawings.
- G. Conduit for control wiring shall be provided by Division 26.

END OF SECTION

SECTION 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation
- B. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

Provide_Product Data for each type of product indicated in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.09 EXTRA MATERIALS

Not required.

1.10 <u>RECORD DRAWINGS</u>

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 <u>SLEEVES</u>

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

- A. Manufactures: Subject to compliance with requirements, provide product indicated on drawings or comparable product by one of the following:
 - 1. Advance Products & Systems, Inc
 - 2. CALPICO, Inc
 - 3. Metraflex Company
 - 4. Pipeline Seal and Insulator, Inc
 - 5. Proco Products, Inc
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.03 <u>GROUT</u>

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.

- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller than NPS 6 (DN 150): Cast-iron wall sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.

- 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
- b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
- 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
- 4. Concrete Slabs above Grade:
 - a. Piping Smaller than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.
- 5. Interior Partitions:
 - a. Piping Smaller than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

SECTION 22 05 18

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation
- B. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

Product Data: For each type of product indicated in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.02 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, castbrass type with polished, chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.

- h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
- i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
- j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with roughbrass finish.
- k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor-plate type.

3.02 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

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SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation
- B. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Iron, single-flange butterfly valves.
 - 4. Bronze swing check valves.
 - 5. Iron swing check valves.
 - 6. Iron swing check valves with closure control.
 - 7. Bronze gate valves.
 - 8. Iron gate valves.

1.03 STANDARDS AND REFERENCES

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

Product Data: For each type of valve indicated, provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves.
- E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
 - 1. Gate Valves: With rising stem.
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

- 3. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.

2.02 BRASS BALL VALVES

- A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kitz Corporation.
 - b. Nibco
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Design: One piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Reduced.
- B. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.

- i. Ball: Chrome-plated brass.
- j. Port: Full.
- C. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hammond Valve.
 - b. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Regular.

2.03 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.

j. Port: Full.

2.04 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.

2.05 IRON SWING CHECK VALVES

- A. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Composition.
 - g. Seat Ring: Bronze.
 - h. Disc Holder: Bronze.
 - i. Disc: PTFE or TFE.
 - j. Gasket: Asbestos free.

2.06 BRONZE GATE VALVES

- A. Class 125, NRS Bronze Gate Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Valve, Inc.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Division.
- e. Hammond Valve.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.
- B. Class 125, RS Bronze Gate Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC<http://www.specagent.com/LookUp/?uid=123456805097&mf=04&src=w d>.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Shut-off valves shall be provided in main branches, runs to risers and where indicated on drawings
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install on operators for butterfly valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor. Extend chains to 60 inches (1520 mm above finished floor.
 - 1. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

3.02 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or butterfly valves.
 - 2. Throttling Service: ball, or butterfly valves.
 - 3. Pump-Discharge Check Valves:
 - a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
 - c. NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

3.04 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

- 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
- 2. Bronze Angle Valves: Class 125, bronze disc.
- 3. Ball Valves: Two piece, full port, brass or bronze with brass trim.
- 4. Bronze Swing Check Valves: Class 125, bronze or nonmetallic disc.
- 5. Bronze Gate Valves: Class 125, NRS.
- B. Pipe NPS 2-1/2 (DN 65) and Larger:
 - 1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100): May be provided with threaded ends instead of flanged ends.
 - 2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
 - 3. Iron Swing Check Valves: Class 125, nonmetallic-to-metal seats.
 - 4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
 - 5. Iron Gate Valves: Class 125 OS&Y.
 - 6. Iron Globe Valves: Class 125.

3.05 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two piece, full port, brass or bronze with brass trim.
 - 3. Bronze Swing Check Valves: Class 125, bronze disc.
 - 4. Bronze Gate Valves: Class 125, NRS.
- B. Pipe NPS 2-1/2 (DN 65) and Larger:
 - 1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100): May be provided with threaded ends instead of flanged ends.
 - 2. Iron Swing Check Valves: Class 125, nonmetallic-to-metal seats.
 - 3. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
 - 4. Iron Gate Valves: Class 125, OS&Y.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Pipe positioning systems.
 - 6. Equipment supports.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7
 - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.04 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- D. Comply with the Industry Standards and References as established by Manufacturer(s).

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- C. Provide:
 - 1. Product Data: For each type of product indicated.
 - 2. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - i. Trapeze pipe hangers.
 - ii. Equipment supports.
 - 3. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 4. Information Submittal: Welding certificates.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 <u>WARRANTY</u>

Provide in accordance with:

A. Project Manual Volume One, Sections 00710, Article 6.12 – Contractor's General Warranty and Guarantee.

- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

- 2.01 METAL PIPE HANGERS AND SUPPORTS
 - A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 - B. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factoryfabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa), ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.05 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.06 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.07 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before
concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
 - 5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicateinsulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting." And Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.

- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
 - Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

- 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
- 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
- 6. C-Clamps (MSS Type 23): For structural shapes.
- 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
- 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 - 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 - 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Vibration isolation requirements.
 - 2. Seismic control requirements.
 - 3. Vibration-isolated equipment support bases.
 - 4. Vibration isolators.
- C. Related Section: 033000 Cast-in-Place Concrete.

1.03 STANDARDS AND REFERENCES

- A. ASHRAE (HVACA) ASHRAE Handbook HVAC Applications; 2015.
- B. FEMA 412 Installing Seismic Restraints for Mechanical Equipment; 2002.
- C. FEMA 413 Installing Seismic Restraints for Electrical Equipment; 2004.
- D. FEMA 414 Installing Seismic Restraints for Duct and Pipe; 2004.
- E. FEMA E-74 Reducing the Risks of Nonstructural Earthquake Damage; 2011.
- F. SMACNA (SRM) Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association; 2008.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Seismic Controls:
 - a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and non-essential components in consideration of seismic interaction.

- 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:

Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.05 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.06 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.07 <u>SUBMITTALS</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.

1.08 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

Not required.

1.11 RECORD DRAWINGS

Not required.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing plumbing equipment and/or plumbing connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
- D. Equipment Isolation: As indicated on drawings.
- E. Piping Isolation:
 - 1. Provide vibration isolators for piping supports:
 - a. Located in equipment rooms.
 - b. Located within 50 feet of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
 - 2. Minimum Static Deflection:

First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.

2.02 SEISMIC CONTROL REQUIREMENTS

- A. Design and provide plumbing component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor plumbing components.
- B. Seismic Design Criteria: As indicated on drawings.
- C. Seismic Restraints:
 - 1. Provide seismic restraints for plumbing components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
 - 2. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
 - a. ASHRAE (HVACA).
 - b. FEMA 412.
 - c. FEMA 413.
 - d. FEMA 414.
 - e. FEMA E-74.
 - f. SMACNA (SRM).
 - 3. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third party registered professional engineer acceptable to authorities having jurisdiction.

- D. Seismic Attachments:
 - 1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
 - 2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
 - 3. Do not use power-actuated fasteners.
 - 4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
 - 5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 - 6. Concrete Housekeeping Pads:
 - a. Increase size of pad as required to comply with anchor requirements.
 - b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.
- E. Seismic Interactions:
 - 1. Include provisions to prevent seismic impact between plumbing components and other structural or nonstructural components.
 - 2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
- F. Seismic Relative Displacement Provisions:
 - 1. Use suitable fittings or flexible connections to accommodate:
 - a. Relative displacements at connections between components, including distributed systems (e.g. piping); do not exceed load limits for equipment utility connections.
 - b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
 - c. Design displacements at seismic separations.
 - d. Anticipated drifts between floors.

2.03 MANUFACTURERS

- A. California Dynamics Corp: www.caldyn.com.
- B. Mason Industries; _____: www.mason-ind.com/#sle.

2.04 PERFORMANCE REQUIREMENTS

- A. General:
 - 1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.

2.05 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- E. Vibration Isolation Systems:
 - 1. Vibration-Isolated Equipment Support Bases:
 - a. Provide specified minimum clearance beneath base.
 - 2. Clean debris from beneath vibration-isolated equipment that could cause short circuiting of isolation.
 - 3. Use elastomeric grommets for attachments where required to prevent short circuiting of isolation.
 - 4. Adjust isolators to be free of isolation short circuits during normal operation.
 - 5. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.
- F. Seismic Controls:
 - 1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
 - 2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
 - 3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
 - 4. Equipment with Sheet Metal Housings:
 - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
 - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
 - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
 - 5. Concrete Housekeeping Pads:
 - a. Size in accordance with seismic design to meet anchor requirements.
 - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.

3.02 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

C. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 Quality Requirements, for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Vibration Isolation Systems:
 - 1. Verify isolator static deflections.
 - 2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- D. Seismic Controls:
 - 1. Verify snubbing element air gaps.
- E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- F. Inspect isolated equipment after installation and submit report. Include static deflections.

3.04 SCHEDULES

- A. Pipe Isolation Schedule.
 - 1. 1 Inch Pipe Size: Isolate 120 diameters from equipment.
 - 2. 2 Inch Pipe Size: Isolate 90 diameters from equipment.
 - 3. 3 Inch Pipe Size: Isolate 80 diameters from equipment.
 - 4. 4 Inch Pipe Size: Isolate 75 diameters from equipment.
 - 5. 6 Inch Pipe Size: Isolate 60 diameters from equipment.
 - 6. 8 Inch Pipe Size: Isolate 60 diameters from equipment.
 - 7. 10 Inch Pipe Size: Isolate 54 diameters from equipment.
 - 8. 12 Inch Pipe Size: Isolate 50 diameters from equipment.
 - 9. 16 Inch Pipe Size: Isolate 45 diameters from equipment.
 - 10. 24 Inch Pipe Size: Isolate 38 diameters from equipment.
 - 11. Over 24 Inch Pipe Size: As indicated.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Nameplates.
 - 2. Tags.
 - 3. Stencils.
 - 4. Ceiling tacks.
- C. Related requirements: Section 099123 Interior Painting: Identification painting.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- C. Provide: List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Not required.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 <u>WARRANTY</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Piping: Pipe markers.
- B. Pumps: Nameplates.
- C. Small-sized Equipment: Tags.
- D. Valves: Tags and ceiling tacks where located above lay-in ceiling.
- E. Water Treatment Devices: Nameplates.

2.02 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Champion America, Inc: www.Champion-America.com.
- C. Seton Identification Products: www.seton.com/aec.

2.03 <u>NAMEPLATES</u>

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 3. Seton Identification Products: www.seton.com/#sle.
- B. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.

2.04 <u>TAGS</u>

- A. Manufacturers:
 - 1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
 - 2. Brady Corporation: www.bradycorp.com/#sle.
 - 3. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 5. Seton Identification Products: www.seton.com/#sle.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.05 STENCILS

- A. Manufacturers:
 - 1. Brady Corporation: www.bradycorp.com/#sle.
 - 2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com/#sle.
 - 3. Seton Identification Products: www.seton.com/#sle.
- B. Stencils: With clean cut symbols and letters of following size:
 - 1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
 - 2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
 - 3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
- C. Stencils shall be identified as indicated below including direction of flow
 - 1. Gravity Condensate G.C.
 - 2. Domestic Cold Water D.C.W.
 - 3. Domestic Hot Water D.H.W.
 - 4. Domestic Hot Water Return D.H.W.R.
- D. Stencil Paint: Semi-gloss enamel, colors conforming to ASME A13.1.

2.06 CEILING TACKS

- A. Manufacturers:
 - 1. Craftmark: www.craftmarkid.com/#sle.
- B. Description: Steel with 3/4 inch diameter color coded head.
- C. Color code as follows:
 - 1. Plumbing Valves: Green.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install tags with corrosion resistant chain.
- B. Apply stencil painting in accordance with Section 099123.
- C. Use tags on piping 3/4 inch diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- D. Identify valves in main and branch piping with tags.
- E. Identify piping, concealed or exposed, with stenciled painting. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Piping insulation.
 - 2. Jackets and accessories.

1.03 STANDARDS AND REFERENCES

- A. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- B. ASTM B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- C. ASTM C177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- D. ASTM C533 Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2013.
- E. ASTM C534/C534M Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.
- F. ASTM C547 Standard Specification for Mineral Fiber Pipe Insulation; 2015.
- G. ASTM C552 Standard Specification for Cellular Glass Thermal Insulation; 2016a.
- H. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- I. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- J. UL 723 Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.

B. Provide:

- 1. See Section 013000 Administrative Requirements, for submittal procedures.
- 2. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.
- 3. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 WARRANTY

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
 - 2. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- B. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 <u>REGULATORY REQUIREMENTS</u>

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com.
 - 2. Johns Manville Corporation: www.jm.com.
 - 3. Knauf Insulation: www.knaufusa.com.
 - 4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perminches.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
 - 1. Aeroflex USA, Inc: www.aeroflexusa.com.
 - 2. Armacell LLC: www.armacell.us.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: Minus 40 degrees F.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.

2.04 JACKETS

- A. PVC Plastic.
 - 1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com.
 - 2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.
- B. ABS Plastic:
 - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: Minus 40 degrees F.
 - b. Maximum Service Temperature: 180 degrees F.

- c. Moisture Vapor Permeability: 0.012 perm inch, when tested in accordance with ASTM E96/E96M.
- d. Thickness: 30 mil.
- e. Connections: Brush on welding adhesive.
- C. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
 - 1. Thickness: 0.016 inch sheet.
 - 2. Finish: Smooth.
 - 3. Joining: Longitudinal slip joints and 2 inch laps.
 - 4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - 5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Install insulation on piping accessories requiring future re-occurring access and service with factory fabricated insulation covers that are easily removed and reapplied
- F. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with selfsealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- G. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or fieldapplied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- H. Inserts and Shields:
 - 1. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

- 2. Insert Location: Between support shield and piping and under the finish jacket.
- 3. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.
- J. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

END OF SECTION

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SECTION 22 10 05

PLUMBING PIPING

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SECTION INCLUDES

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation
- B. Section includes, but is not limited to: Pipe, pipe fittings, specialties, and connections for piping systems.
 - 1. Sanitary sewer and vent.
 - 2. Domestic water.
 - 3. Storm water.
 - 4. Natural Gas.
 - 5. Flanges, unions, and couplings.
 - 6. Pipe hangers and supports.
 - 7. Valves.
 - 8. Water pressure reducing valves.
 - 9. Relief valves.
 - 10. Strainers.

1.03 <u>REFERENCE STANDARDS</u>

- A. ANSI Z21.22 American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).
- B. ASME B16.3 Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- C. ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- D. ASME B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- E. ASME B16.23 Cast Copper Alloy Solder Joint Drainage Fittings DWV; 2011.
- F. ASME B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings DWV; 2012.
- G. ASME B31.1 Power Piping; 2016.
- H. ASME B31.9 Building Services Piping; 2014.
- I. ASME BPVC-IV Boiler and Pressure Vessel Code, Section IV Rules for Construction of Heating Boilers; 2015.
- J. ASME BPVC-IX Boiler and Pressure Vessel Code, Section IX Welding, Brazing, and Fusing Qualifications; 2015.

- K. ASSE 1003 Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems; 2009.
- L. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- M. ASTM A234/A234M Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2017.
- N. ASTM B32 Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- O. ASTM B42 Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.
- P. ASTM B88 Standard Specification for Seamless Copper Water Tube; 2016.
- Q. ASTM B88M Standard Specification for Seamless Copper Water Tube (Metric); 2016.
- R. ASTM B813 Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
- S. ASTM B828 Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.
- T. ASTM C425 Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings; 2004 (Reapproved 2013).
- U. ASTM C564 Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.
- V. ASTM D1785 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.
- W. ASTM D2235 Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2004 (Reapproved 2011).
- X. ASTM D2239 Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter; 2012a.
- Y. ASTM D2564 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.
- Z. ASTM D2661 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.
- AA. ASTM D2665 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.
- AB. ASTM D2680 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping; 2001 (Reapproved 2014).
- AC. ASTM F628 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core; 2012e2.
- AD. ASTM F708 Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).
- AE. AWS A5.8M/A5.8 Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
- AF. AWWA C105/A21.5 Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.
- AG.CISPI 301 Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009 (Revised 2012).
- AH. CISPI 310 Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011 (Revised 2012).

- AI. MSS SP-58 Pipe Hangers and Supports Materials, Design, Manufacture, Selection, Application, and Installation; 2009.
- AJ. MSS SP-110 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- AK. NSF 61 Drinking Water System Components Health Effects; 2016.
- AL. NSF 372 Drinking Water System Components Lead Content; 2016.
- AM.ASME Boiler and Pressure Vessel Code
- AN. AGA American Gas Association Code

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with State of California, standards. Maintain one copy on project site.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
- E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State of California plumbing code.
- B. Conform to applicable code for installation of backflow prevention devices.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.06 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.07 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
 - 2. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- B. Provide:
 - 1. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
 - 2. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.

- 2. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. ABS Pipe: ASTM F628.
 - 1. Fittings: ABS.
 - 2. Joints: Solvent welded with ASTM D2235 cement.
- B. PVC Schedule 40 DWV Pipe per ASTM D1785 and ASTM D 2665
 - 1. Fittings: PVC DWV per ASTM D 2665
 - 2. Joints: Solvent cement weld per ASTM F 656 and solvent cement per ASTM D2564

2.03 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Pipe: Class 150 bronze unions with brazed joints below grade, hard drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.

2.06 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. ABS Pipe: ASTM D2680.
 - 1. Fittings: ABS.
 - 2. Joints: Solvent welded with ASTM D2235 cement.

2.07 STORM WATER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.08 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: ASME B31.1, welded.
 - 3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.09 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: Threaded or welded to ASME B31.1.
 - 3. All exposed piping shall be painted or jacketed.

2.10 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches and Under:
 - 1. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Grooved and Shouldered Pipe End Couplings:

- 1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
- 2. Sealing gasket: "C" shape composition sealing gasket.

2.11 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 - 4. Vertical Pipe Support: Steel riser clamp.
- B. Plumbing Piping Drain, Waste, and Vent:
 - 1. Conform to ASME B31.9.
 - 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
 - 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
- C. Plumbing Piping Water:
 - 1. Conform to ASME B31.9.
 - 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
 - 3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
 - 4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.

2.12 BALL VALVES

- A. Manufacturers:
 - 1. Tyco Flow Control: www.tycoflowcontrol.com.
 - 2. Apollo Valves: www.apollovalves.com.
 - 3. Stockham: www.stockham.com
- B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

2.13 WATER PRESSURE REDUCING VALVES

- A. Manufacturers:
 - 1. Apollo Valves: www.apollovalves.com.
 - 2. Wilkins Water Control Products: www.zurn.com.
 - 3. Cla-Val Company; _____: www.cla-val.com/#sle.
 - 4. Watts Regulator Company; _____: www.wattsregulator.com/#sle.
- B. Up to 2 Inches:
 - 1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

2.14 <u>RELIEF VALVES</u>

- A. Temperature and Pressure:
 - 1. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

2.15 STRAINERS

- A. Size 2 inch and under:
 - 1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
 - 2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 220516.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Shut-off valves shall be provided on all main branches, runs to risers and where shown on drawings. Locate shut-off valves over T-Bar Ceiling when possible. Provide access panels when shut-off valves are located over hard lid ceilings.
- I. Provide access where valves and fittings are not exposed.
- J. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Color to be specified by architect.
- K. All exposed, unfinished pipe, fittings, supports, and accessories shall be painted.
- L. All piping, fittings, supports and accessories shall approved UV protection
- M. Install valves with stems upright or horizontal, not inverted. Refer to Section 220523.
- N. Provide stem extension on all valves for piping requiring insulation to ensure valve can be cycled without damaging pipe insulation.

- O. Install water piping to ASME B31.9.
- P. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- Q. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install globe valves for throttling, bypass, or manual flow control services.
- C. Provide spring loaded check valves on discharge of water pumps.

3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system in accordance with Section 330110.58.
- B. Prior to starting work, verify system is complete, flushed and clean.

3.06 INSTALLATION OF FLOW CONTROL VALVES

- A. Install automatic flow control valve in each hot water recirculating loop, and elsewhere as indicated. Install a shutoff valve and strainer upstream and a union, check valve and shutoff valve downstream of each automatic flow control valve.
- B. Set flow control valve flow rate as follows:
 - 1. Preliminary Procedures For Hot Water Return System Balancing:
 - a. Before operating the system perform these steps:
 - 1) Open Valves at recirculation pump and flow control valves to full open position.
 - 2) Remove and clean all strainers.
 - 3) Check recirculation pump rotation.
 - 4) Set water heater temperature as indicated on the drawings.
 - 2. Procedures For Hot Water Return System Balancing:
 - a. Refer to the drawings for required flow rate for each flow control valve.
 - b. Provide required instrumentation to obtain proper measurements. Instruments shall be properly maintained and protected against damage.
 - c. Apply instrument as recommended by the manufacturer.
 - d. Take readings with the eye at the level of the indicated valve to prevent parallax.
 - e. Mark flow control valve setting with memory stop. Mark with paint or other suitable, permanent identification materials.

- f. Retest, adjust, and balance systems subsequent to significant systems modifications, and resubmit test results.
- C. Reports: Prepare hot water return system balancing reports signed and submit to the architect upon completion of the project. Include the following information:
 - 1. Valve tag number and description of location
 - 2. Valve body size
 - 3. Differential pressure reading from instrument in psi
 - 4. Actual flow rate derived from the manufacturer's charts and tablets for the valve size and measured differential pressure.

3.07 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.
 - 1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
 - 2. Provide 18 gage, 0.0478 inch galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

END OF SECTION

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SECTION 22 10 06

PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Drains.
 - 2. Cleanouts.
 - 3. Hose bibbs.
 - 4. Washing machine boxes and valves.
 - 5. Backflow preventers.
 - 6. Water hammer arrestors.
 - 7. Sanitary waste interceptors.
 - 8. Mixing valves.

1.03 STANDARDS AND REFERENCE

- A. ASME A112.6.3 Floor and Trench Drains; 2001 (R2007).
- B. ASME A112.6.4 Roof, Deck, and Balcony Drains; 2008 (Reaffirmed 2012).
- C. ASSE 1011 Hose Connection Vacuum Breakers; 2004.
- D. ASSE 1012 Backflow Preventer with Intermediate Atmospheric Vent; 2009.
- E. ASSE 1013 Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
- F. ASSE 1019 Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011.
- G. NSF 2 Food Equipment; 2015.
- H. NSF 61 Drinking Water System Components Health Effects; 2016.
- I. NSF 372 Drinking Water System Components Lead Content; 2016.
- J. PDI-WH 201 Water Hammer Arresters; 2010.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Certificates: Certify that oil interceptors meet or exceed specified requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Accept specialties on site in original factory packaging. Inspect for damage.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

A. Project Manual Volume One, Sections 00710, Article 6.12 – Contractor's General Warranty and Guarantee.

- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

- 2.01 <u>GENERAL REQUIREMENTS</u>
 - A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

- A. Manufacturers:
 - 1. Josam Company; _____: www.josam.com/#sle.
 - 2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - 3. Zurn Industries, LLC; ____: www.zurn.com/#sle.
 - 4. Mifab: www.mifab.com
- B. Roof Drains:
 - 1. Assembly: ASME A112.6.4.
 - 2. Body: Lacquered cast iron with sump.
 - 3. Strainer: Removable polyethylene dome with vandal proof screws.
- C. Floor Drain:
 - 1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
- D. Floor Sink:
 - 1. Cast iron 8 inch square, 6 inch deep flanged receptor with seepage holes, acid resistant coated interior, loose set acid resistant coated cast iron grate, and aluminum dome bottom strainer.
- E. Floor Trough (FT-1):
 - 1. Comply with NSF 2 construction.
 - 2. Slope toward waste or drain.

2.03 <u>CLEANOUTS</u>

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.
 - 2. Josam Company; ____: www.josam.com/#sle.
 - 3. Zurn Industries, LLC; ____: www.zurn.com/#sle.
 - 4. Mifab: www.mifab.com

2.04 HOSE BIBBS

- A. Manufacturers:
 - 1. Woodford: www.woodfordmfg.com.
 - 2. Zurn Industries, LLC; ____: www.zurn.com/#sle.

3. Mifab: www.mifab.com

2.05 WASHING MACHINE BOXES AND VALVES

- A. Box Manufacturers:
 - 1. IPS Corporation/Water-Tite; ____: www.ipscorp.com/#sle.
 - 2. Oatey Supply Chain Services, Inc; ____: www.oatey.com/#sle.
- B. Valve Manufacturers:
 - 1. IPS Corporation/Water-Tite; ____: www.ipscorp.com/#sle.
 - 2. Zurn Industries, LLC; _____: www.zurn.com/#sle.
- C. Description: Plastic preformed rough-in box with brass long shank valves with wheel handles, socket for 2 inch waste, slip in finishing cover.

2.06 BACKFLOW PREVENTERS

- A. Manufacturers:
 - 1. Conbraco Industries, Inc: www.apollovalves.com.
 - 2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
 - 3. Zurn Industries, LLC: www.zurn.com.
- B. Reduced Pressure Backflow Preventers:
 - 1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.07 WATER HAMMER ARRESTORS

- A. Manufacturers:
 - 1. Precision Plumbing Products: www.pppinc.com.
 - 2. Watts Regulator Company, a part of Watts Water Technologies; _____: www.wattsregulator.com/#sle.
 - 3. Zurn Industries, LLC; ____: www.zurn.com/#sle.
 - 4. Mifab: www.mifab.com

2.08 SANITARY WASTE INTERCEPTORS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company; _____: www.jrsmith.com/#sle.
 - 2. Zurn Industries, LLC; ____: www.zurn.com/#sle.
- B. Oil Interceptors:
 - 1. Construction:
 - a. Material: Epoxy coated fabricated steel.
 - b. Rough-in: On floor.
 - c. Cover: Steel, epoxy coated, non-skid with gasket, securing handle, and enzyme injection port, recessed for floor finish.

2.09 MIXING VALVES

- A. Thermostatic Mixing Valves:
 - 1. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Install floor cleanouts at elevation to accommodate finished floor.
- D. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
- E. Pipe relief from backflow preventer to nearest drain.

END OF SECTION

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SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SECTION INCLUDES

- A. Water Heaters:
 - 1. Commercial gas fired.
- B. In-line circulator pumps.

1.03 REFERENCE STANDARDS

ANSI Z21.10.1 - Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less; 2014.

1.04 QUALITY ASSURANCE

QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Certifications:

- 1. Water Heaters: NSF approved.
- 2. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1, as applicable, in addition to requirements specified elsewhere.
- C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Product Data:
 - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - 2. Indicate pump type, capacity, and power requirements.
 - 3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - 4. Provide electrical characteristics and connection requirements.
- B. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Provide five year manufacturer warranty for domestic water heaters.

PART 2 - PRODUCTS

2.01 WATER HEATERS

- A. Manufacturers:
 - 1. A.O. Smith Water Products Co; _____: www.hotwater.com/#sle.
 - 2. Rheem Manufacturing Company; _____: www.rheem.com/#sle.
- B. Commercial Gas Fired:
 - 1. Type: Automatic, natural gas-fired, vertical storage.
 - 2. Performance:
 - a. Energy Factor: 0.80.
 - b. Storage Capacity: 100 gal.
 - c. First Hour Rating: 223 gal.

- d. Input: 150,000 Btuh at sea level.
- 3. Tank: Glass lined welded steel ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
- 4. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Brass.
 - c. Drain valve.
 - d. Anode: Magnesium.

2.02 IN-LINE CIRCULATOR PUMPS

- A. Manufacturers:
 - 1. Armstrong Fluid Technology; _____: www.armstrongfluidtechnology.com/#sle.
 - 2. Bell & Gossett, a xylem brand; _____: www.bellgossett.com/#sle.
 - 3. Taco Pumps: www.taco-hvac.com.
- B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
- C. Impeller: Bronze.
- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- E. Seal: Carbon rotating against a stationary ceramic seat.
- F. Drive: Flexible coupling.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.
- C. Pumps:
 - 1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

3.02 SCHEDULES - SEE SHEET P-0.1

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SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SECTION INCLUDES

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Water closets.
 - 2. Urinals.
 - 3. Lavatories.
 - 4. Sinks.
 - 5. Service sinks.
 - 6. Under-lavatory pipe supply covers.
 - 7. Electric water coolers.
 - 8. Drinking fountains.
 - 9. Showers.
 - 10. Eye wash fountains.
 - 11. Emergency showers.

1.03 STANDARDS AND REFERENCE

- A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASME A112.18.9 Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011.
- C. ANSI Z124.2 American National Standard for Plastic Shower Units; 1995.
- D. ANSI Z358.1 American National Standard for Emergency Eyewash and Shower Equipment; 2014.
- E. ASHRAE Std 18 Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008.
- F. ASME A112.6.1M Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2002).
- G. ASME A112.18.1 Plumbing Supply Fittings; 2012.
- H. ASME A112.19.1M Enameled Cast Iron Plumbing Fixtures; The American Society of Mechanical Engineers; 2008 (R2011).
- I. ASME A112.19.2 Ceramic Plumbing Fixtures; 2013.

- J. ASME A112.19.3 Stainless Steel Plumbing Fixtures; 2008 (R2013).
- K. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- L. ICC A117.1 Accessible and Usable Buildings and Facilities; 2017.
- M. NSF 61 Drinking Water System Components Health Effects; 2016.
- N. NSF 372 Drinking Water System Components Lead Content; 2016.
- O. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Accept fixtures on site in factory packaging. Inspect for damage.
- D. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

- 2.01 GENERAL REQUIREMENTS
 - A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 FLUSH VALVE WATER CLOSETS

- A. Water Closets: Vitreous china, ASME A112.19.2, wall hung, siphon jet flush action, china bolt caps.
 - 1. Flush Volume: 1.28 gallon, maximum.
 - 2. Flush Valve: Exposed (top spud).
 - 3. Flush Operation: Sensor operated.
 - 4. Handle Height: 44 inches or less.
 - 5. Manufacturers:
 - a. American Standard Inc: www.americanstandard.com.
 - b. Sloan Valve Company: www.sloanvalve.com.
 - c. Kohler Company; ____: www.kohler.com/#sle.
 - d. Substitutions: See Section 016000 Product Requirements.
- B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
 - 1. Sensor-Operated Type: Solenoid or motor-driven operator, low voltage hard-wired, infrared sensor with mechanical over-ride or over-ride push button.
 - 2. Manufacturers:
 - a. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
 - b. Delany Products; _____: www.delanyvalve.com/#sle.
 - c. Sloan Valve Company; _____: www.sloanvalve.com/#sle.

C. Seats:

- 1. Manufacturers:
 - a. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
 - b. Bemis Manufacturing Company; _____: www.bemismfg.com/#sle.
 - c. Olsonite; _____: www.olsonite.com/#sle.
 - d. Substitutions: See Section 016000 Product Requirements.
- 2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, with cover.

D. Water Closet Carriers:

- 1. Manufacturers:
 - a. JOSAM Company; _____: www.josam.com/#sle.
 - b. Jay R. Smith MFG Co: www.jrsmith.com
 - c. Substitutions: See Section 016000 Product Requirements.
- 2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.03 WALL HUNG URINALS

- A. Wall Hung Urinal Manufacturers:
 - 1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
 - 2. Kohler Company; _____: www.kohler.com/#sle.
- B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
 - 1. Flush Volume: 1.0 gallons, maximum.
 - 2. Flush Style: Washout.
 - 3. Flush Valve: Exposed (top spud).
 - 4. Flush Operation: Sensor operated.
 - 5. Trap: Integral.
 - 6. Removable stainless steel strainer.
- C. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
 - 1. Sensor-Operated Type: Solenoid or motor-driven operator, low voltage hard-wired, infrared sensor with mechanical over-ride or over-ride push button.
 - 2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
- D. Manufacturers:
 - 1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
 - 2. Delany Products; _____: www.delaneyvalve.com/#sle.
 - a. Sloan Valve Company; _____: www.sloanvalve.com/#sle.
- E. Carriers:
 - 1. Manufacturers:
 - a. JOSAM Company; _____: www.josam.com/#sle.

b. Jay R. Smith MFG Co: www.jrsmith.com_____.

2.04 LAVATORIES

- A. Lavatory Manufacturers:
 - 1. American Standard Inc.: www.americanstandard.com
 - 2. Kohler Company: www.kohler.com
- B. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, ____ by ____ inch minimum, with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.
- C. Vitreous China Counter Top Basin:
 - 1. ASME A112.19.2; vitreous china self-rimming counter top lavatory, 20 1/4 x 17 1/2 inches with drillings on 4 inch centers, front overflow, seal of putty, calking, or concealed vinyl gasket.
- D. Supply Faucet Manufacturers:
 - 1. Chicago Faucets, a Geberit company: www.chicagofaucets.com.
 - 2. Kohler Company; ____: www.kohler.com/#sle.
- E. Metered Faucet: ASME A112.18.1; chrome plated metered mixing faucet with battery operated solenoid operator and infrared sensor, aerator and cover plate, open grid strainer.
- F. Supply Faucet:

ASME A112.18.1; chrome plated combination supply fitting with pop-up waste, water economy aerator with maximum 0.5 gpm flow, indexed handles.

- 1. ASME A112.18.1; chrome plated metered mixing faucet with low voltage operated solenoid operator and infrared sensor, 0.5 gpm aerator and cover plate, open grid strainer.
- G. Sensor Operated Faucet: Cast brass, chrome plated, wall mounted with sensor located on neck of spout.
 - 1. Spout Style: Standard.
 - 2. Power Supply: Battery, easily replaceable, alkaline or lithium, minimum 200,000 cycles.
 - 3. Mixing Valve: Internal, automatic.
 - 4. Water Supply: 3/8 inch compression connections.
 - 5. Aerator: Vandal resistant, 0.5 GPM, laminar flow device.
 - 6. Finish: Polished chrome.
 - 7. Sensor Operated Faucet Manufacturers:
 - a. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
 - b. The Chicago Faucet Company; _____: www.chicagofaucets.com/#sle.
 - c. Moen Incorporated; ____: www.moen.com/#sle.
 - d. Sloan Valve Company; _____: www.sloanvalve.com/#sle.
 - e. Substitutions: See Section 016000 Product Requirements.
- H. Accessories:
 - 1. Wheel handle stops.

- 2. Rigid supplies.
- 3. Carrier:
 - a. Manufacturers:
 - 1) JOSAM Company; _____: www.josam.com/#sle.
 - 2) Jay R. Smith MFG Co: www.jrsmith.com_____.

2.05 <u>SINKS</u>

- A. Sink Manufacturers:
 - 1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
 - 2. Kohler Company; _____: www.kohler.com/#sle.
 - 3. Elkay____.
- B. Single Compartment Bowl:
 - 1. ASME A112.19.3; 25 x 22 x 7 11/16 in outside dimensions, 19 gage thick, Type 304 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
 - a. Drain: 1-1/2 inch chromed brass drain.
- C. Double Compartment Bowl:
 - 1. ASME A112.19.3; 33 x 22 x 8 3/16 inch outside dimensions, 19 gage thick, Type 304 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
 - a. Drain: 1-1/2 inch chromed brass drain.
- D. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, wheel handle stop, rigid supplies.

2.06 UNDER-LAVATORY PIPE SUPPLY COVERS

- A. Manufacturers:
 - 1. Plumberex Specialty Products, Inc; ____: www.plumberex.com/#sle.
 - 2. Substitutions: See Section 016000 Product Requirements.
- B. General:
 - 1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
 - 2. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
 - a. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
 - b. Comply with ICC A117.1.
 - 3. Color: High gloss white.
 - 4. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.

2.07 <u>SHOWERS</u>

- A. Shower Manufacturers:
 - 1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
- B. Shower Valve:
 - 1. Comply with ASME A112.18.1.

- 2. Provide two handle in wall diverter valve body with integral thermostatic mixing valve to supply 1.8 gpm.
- C. Trim:
 - 1. ASME A112.18.1; concealed shower supply with pressure balanced mixing valves, integral service stops, bent shower arm with adjustable spray ball joint shower head with maximum 1.5 flow, and escutcheon.

2.08 ELECTRIC WATER COOLERS

- A. Electric Water Cooler Manufacturers:
 - 1. Elkay Manufacturing Company; _____: www.elkay.com/#sle.
 - 2. Haws Corporation; _____: www.hawsco.com/#sle.
 - 3. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
 - 4. Electrical: 115 V, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

2.09 SERVICE SINKS

- A. Service Sink Manufacturers:
 - 1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
 - 2. Elkay Manufacturing Company; ____: www.elkay.com/#sle.
 - 3. Just Manufacturing Company; _____: www.justmfg.com/#sle.
- B. Bowl: 36 by 24 by 10 inch high white molded stone, floor mounted, with one inch wide shoulders, vinyl bumper guard, stainless steel strainer.
- C. Trim: ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.
- D. Accessories:
 - 1. Hose clamp hanger.
 - 2. Mop hanger.

2.10 EMERGENCY EYE WASH

- A. Emergency Wash Manufacturers:
 - 1. Haws Corporation; _____: www.hawsco.com/#sle.
 - 2. Bradley_____.
- B. Emergency Wash: ANSI Z358.1; counter top, self-cleaning, non-clogging eye wash with quick opening, full-flow valves, stainless steel eye wash receptor, twin eye wash heads and face spray ring, stainless steel dust cover, copper alloy control valve and fittings.

2.11 EMERGENCY SHOWERS

- A. Emergency Shower Manufacturers:
 - 1. Haws Corporation; _____: www.hawsco.com/#sle.
- B. Emergency Shower: ANSI Z358.1; wall-mounted, self- cleaning, non-clogging 8 inch diameter stainless steel deluge shower head with elbow, one inch full flow valve with pull chain and 8 inch diameter ring, one inch interconnecting fittings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with loose key or integral stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall supports and bolts.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 00 10

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to: Basic Mechanical Requirements specifically applicable to Division 23 Sections, in addition to Division 01 General Requirements.
- C. Work included: The complete Heating, Ventilating and Air Conditioning (HVAC) systems, including but not limited to these major items:
 - 1. Coordinate work of this Section with related trades.
 - 2. Verify applicable dimensions at the jobsite.
 - 3. Duct systems; supply, return and exhaust complete with fire dampers, combination fire-smoke dampers, and manual dampers.
 - 4. Diffusers and registers.
 - 5. Exhaust supply, return fans and air curtains.
 - 6. Furnishing and installation of miscellaneous hangers, supports, sleeves, inserts, anchors and other auxiliary equipment for systems under this Division.
 - 7. Duct lining and insulation.
 - 8. Shop drawings.
 - 9. Equipment identification.
 - 10. Equipment and systems adjustments and balancing.
 - 11. Air, water and gas systems testing, adjusting and balancing.
 - 12. Written operating and maintenance instructions.
 - 13. Record drawings.
 - 14. Guarantee.

1.03 LOCATIONS AND ACCESSIBILITY

A. Drawings show pipe and ductwork diagrammatically. Conform to Drawings as closely as possible in layout work. Vary run of piping, run and shape of ductwork and make offsets during progress of work as required to meet structural and other interferences as approved by Architect. Install piping and ductwork to best suit field conditions after coordinating with other trades. Run exposed piping and ductwork parallel to, or at right angle to, building walls. Keep horizontal lines as close to bottom of structures as possible. Conform to ceiling heights established on Drawings.

- B. Install equipment in such a manner as to be readily accessible for maintenance and repairs. Install piping, ducts and conduit in such a manner as to preserve headroom, avoid obstructions and keep openings and passageways clear.
- C. Installation at valves, thermometers, gauges, cleanouts, dampers, controls, steam and water specialties, duct access doors or any other indicating equipment or specialties requiring reading, adjustment, inspection, maintenance shall be conveniently and accessible located with reference to the finished building.
- D. Where wall and ceiling access doors are required but not shown, such doors shall be furnished under other sections and as directed by the Architect. Coordinate this requirement with appropriate trade.
- E. If changes in the indicated locations or arrangements are required, they shall be made without additional charges.
- F. In an existing area, where required, remove, reinstall, reconnect or replace, etc., any existing work to accommodate new work without any additional cost to the Owner. Material shall match existing, unless otherwise specified or approved in writing by the Architect.
- G. Provide sheaves and belts if required, to Test, Adjust and Balance Agency, to allow air moving equipment to meet flow requirements specified at no additional cost to the Owner.

1.04 SEISMIC DESIGN

Contractor shall be responsible for anchors and connections of mechanical work to the building structure including calculations for approval by structural engineer or for approval by inspector of record, as applies, for items or work, where approval is deferred or where alternate support or anchorage detail is proposed to prevent damage as a result of an earthquake, including manufactured equipment, the connection and integrity of shop fabricated and field fabricated materials and equipment. The anchorage of all pipes, ducts, conduits, fixtures, equipment, etc. shall withstand the lateral forces and shall accommodate calculated building displacement as required by the California Building Code, and local city/county codes. (Building equipment and connections therefore shall be designed to resist lateral seismic forces equal to 1.0 of equipment weight to working allowable stress. Cantilever posts supporting equipment shall be designed to resist lateral seismic forces equal to 5.0 of equipment weight to allowable working stress. Conform to the following:

- 1. In accordance with Title 24, 2016 CBC Chapter 16A, details shall be provided for the seismic anchorage of all mechanical and electrical equipment, anchorage details shall be based upon appropriate design calculations.
- 2. For equipment weighing 400 pounds or more anchorage details and appropriate design calculations shall be submitted as part of the mechanical and electrical drawings. "Deferred Approval" items will not be permitted unless specifically approved by the plan check supervisor.
 - Exception: Attachments of equipment weighting less than 400 pounds and supported directly on the floor or roof structure, furniture, or temporary or movable equipment and equipment weighing less than 20 pounds that is supported by vibration isolation devices suspended from the roof, wall or floor, need not be detailed on the plans provided the following notes are included on the mechanical and electrical plans.
- 3. The seismic anchorage of mechanical and electrical equipment shall conform to C.C.R. Title 24, 2016 CBC Chapter 16A. Anchorage details for roof/floor-mounted equipment shall be shown on plans.

1.05 STANDARDS AND REFERENCES

- A. Comply with the Industry Standards and References as established by Manufacturer.
- B. Section 230801 Commissioning of Building Systems.

1.06 ORDINANCES, REGULATIONS AND CODES

- A. References to Technical Societies, Trade Organizations, Governmental Agencies is made in Division 15 in accordance with the following abbreviations.
 - 1. AFI Air Filter Institute
 - 2. AMCA Air Moving & Conditioning Association
 - 3. ARI Air Conditioning & Refrigeration Institute
 - 4. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
 - ASME American Society of Mechanical Engineers
 - ASTM American Society of Testing Materials
 - 7. AWSC American Welding Society Code
 - 8. ANSI American National Standards Institute
 - 9. CBC California Building Code
 - 10. CCR California Code of Regulations
 - 11. CEC California Electrical Code
 - 12. CFC California Fire Codes
 - 13. CMC California Mechanical Code
 - 14. CPC California Plumbing Code
 - 15. FIA Factory Insurance Association
 - 16. NAFM National Association of Fan Manufacturers
 - 17. NEMA National Electrical Manufacturer's Association
 - 18. NFPA National Fire Protection Association
 - 19. ORS Office of Regulatory Services
 - 20. SCAQMD South Coast Air Quality Management District
 - 21. SMACNA Sheet Metal and Air Conditioning Contractors National Association
 - 22. UFC Uniform Fire Code
 - 23. UL Underwriter's Laboratories
 - 24. UPC Uniform Plumbing Code
- B. Requirements of Regulatory Agencies: Materials and installation shall comply with applicable local, state, and national codes and ordinances. Rulings and interpretations of the enforcing agencies shall be considered as part of the local codes. No extras will be permitted for furnishing items required by the local codes but not specified or shown on the drawings.
- C. Codes and Standards:
 - 1. IBC and California Amendments (California Building Code Part 2, Title 24, CCR).
 - 2. UMC and California Amendments (California Mechanical Code Part 4, Title 24 CCR).
 - 3. UPC and California Amendments (California Plumbing Code Part 5, Title 24 CCR).
 - 4. Uniform Fire Code with State Amendments (California Fire Code Part 9, Title 24 CCR).

- 5. National Fire Protection Associations National Fire Code.
- D. Nothing in these drawings and specifications is to be construed to permit work in violation thereof. Ordinances, regulations and codes are to be construed as minimum requirements.
- E. The responsibility of the Architect to conduct construction reviews of the Contractor's performance is not intended to include the adequacy of the Contractor's safety measures in, on, or near the construction site.
- F. Ventilating, refrigeration and electrical equipment and appliances are required to be approved by the Underwriters' Laboratories, Inc., or other nationally recognized testing agency and installed per the testing agency's specifications.

1.07 QUALITY ASSURANCE

Unless otherwise specified, equipment and materials used in the installation shall be new and in perfect condition when installed. Articles provided for the same general purpose or use shall be of the same make. Workmanship shall be of the best quality and none but competent mechanics skilled in their trades shall be employed. Furnish the services of an experienced superintendent, who shall be constantly in charge of the work, together with all necessary journeymen, helpers and laborers required.

1.08 SUBSTITUTIONS

- A. Substitutions will be considered per:
 - 1. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
 - 2. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".
- B. The design has been based on data from certain manufacturers, suitable for each application. Recommendations for alternative manufacturers are made for each product, except when "no substitutions permitted" is indicated.
- C. It is the intent of the Owner to have this project constructed with materials, products and system originally designed and specified into the project.
- D. Alternatives that may require the modification, realignment and/or adjustment of other associated components, including impact on other trades, shall be accomplished at no additional cost or time to the contract and shall have the approval of the Architect.
- E. Substitutions shall be submitted addressing all features listed in the specifications. Features that deviate from the plans and specifications shall be clearly identified including justification for deviations. Design West Engineers will review initial submittal on substitutes only. Subsequent submittals made to correct deficiencies in original submittals will be reviewed at Contractor's expense based on Design West Engineer's hourly rate for engineering services.

1.09 SUBMITTALS

A. Provide in accordance with:

- 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Before starting work, the Contractor shall furnish for the approval of the Architect, Shop Drawings and Submittals with Itemized Equipment Lists, complete in all details that they proposes to install. All items shall be submitted at the same time.
- C. Submittals must be specific to this project with respect to model number, capacities, performance, etc., generic submittals will not be accepted.

- D. Variations or deviations on submitted items from that specified must be clearly tagged and / or identified
- E. Submittals shall include, but not necessarily be limited to the following which are mandatory:
 - 1. Draw Equipment Layouts to ¼" scale, including equipment, piping accessories, and showing clearances for operating and servicing.
 - 2. Schedule of pipe, fittings, valves, with manufacturer and catalog number.
 - 3. Specialties, valves, gauges and thermometers of all types.
 - 4. Foundations, supports, hangers, inserts.
 - 5. Earthquake supports and calculations.
 - 6. Insulation.
 - 7. Ventilation and air conditioning equipment, specialties and the air control systems.
 - 8. Fans, fan characteristic curves, fan tests.
 - 9. Dampers, louvers, grilles, registers, diffusers.
 - 10. Shop fabrication drawings and installation drawings of ductwork and piping layouts. Submit for approval prior to fabrication. Drawings shall indicate dimensions from bottom of piping and ductwork to finish floor level.
 - 11. Wiring diagrams, control panel board, motor starters and controls for electrically operated equipment furnished by mechanical trades.
 - 12. Automatic control system diagrams.
 - 13. Exhaust, supply and return fans.
 - 14. Access panels.
 - 15. Hangers, inserts, supports, anchors.
 - 16. Pipe, fittings and specialties.
 - 17. Pipe isolators.
 - 18. Sleeves, escutcheons, caulking, waterproofing, fireproofing.
 - 19. Expansion joints, guides and anchors.
 - 20. Shop fabrications drawings and calculations.
 - 21. Special and miscellaneous products furnished under this section and not listed herein.

1.10 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.11 OPERATION AND MAINTENANCE DATA

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Article 6.12 Record Documents.
 - 2. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
 - 3. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

- B. Manuals: Obtain data from the various manufacturers and submit instruction, operation, and maintenance manuals as required and to the extent required under other Sections.
- C. Contents: Each manual shall have an index listing the contents. Information in the manuals shall include not less than:
 - 1. General introductions and overall equipment description, purpose, functions and simplified theory of operation.
 - 2. Specifications
 - 3. Installation instructions, procedures, sequences, and precautions, including tolerances for level, horizontal and vertical alignment.
 - 4. Grouting requirements.
 - 5. List showing lubricants for each item of mechanical equipment and recommended lubrication intervals.
 - 6. Start-up and beginning operation procedures.
 - 7. Operational procedures.
 - 8. Shutdown procedures.
 - 9. Maintenance and calibration procedures
 - 10. Parts lists
 - 11. Name, address and telephone number of each manufacturer's local representative.
- D. Manual Submittals: Unless otherwise specified, each submittal shall include two copies of each manual, one of which will be returned to the Contractor, marked to show the required review. When approved, deliver four copies to Architect unless otherwise specified.

1.12 EXTRA MATERIALS

Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.13 RECORD DRAWINGS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
 - 2. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
 - 3. Project Manual Volume Four, Section 01 78 39 Project Record Documents.
- B. Record Set During the Work: At site, maintain at least one set of Drawings as a Field Record Set. Also maintain at least one copy of all Addenda, Modifications, approved submittals, correspondence, and transmittals at site. Keep Drawings and data in good order and readily available to Architect and Owner.
- C. Changes: Clearly and correctly mark Record Drawings to show changes made during the construction process at the time the changed work is installed. No such changes shall be made in the work unless authorized by the Architect.
- D. Final Record Drawings: Conform to Division 01 requirements.
- E. Preparation of Final Record Drawings: Contractor shall transfer recorded changes in the work indicated on the Field Record Set to the record set. Changes shall be neatly and clearly drawn and noted by skilled draftsmen, and shown technically correct.
- F. Approval: Prior to Architect's inspection for Substantial Completion, submit the Final Record Drawings to the Architect for review, and make such revisions as may be necessary for Final Record Drawings to be a true, complete, and accurate record of the work.

I. "As-Built" drawings of ductwork and piping, including all elbows, transitions, damper and valve locations shall be provided prior to commencement of air and water balance.

1.14 <u>WARRANTY</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
 - 2. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
 - 3. Project Manual Volume Four, Section 01 77 00.
- B. Contractor shall guarantee workmanship, equipment and materials installed under his contract for a period of not less than one (1) year from the date of Substantial Completion. Should any defects occur during this period, the Contractor shall promptly repair or replace the defective item and any other damage caused to the building free of charge to the Owner, including cost of labor and materials.
- C. Guarantee included in this section to cover:
 - 1. Faulty or inadequate design of equipment or material installed
 - 2. Improper assembly or erection
 - 3. Defective workmanship or material
 - 4. Incorrect or inadequate operation or other failure
- D. He shall guarantee the complete and perfect operation of the entire system and that equipment will be supported in such a way as to be free of objectionable vibration and noise
- E. Furnish the parts and labor to replace any items found to be defective in the refrigeration equipment with the guarantee period
- F. In addition to other guarantees, furnish free maintenance for the refrigeration equipment, including replacement of refrigerant and oil, for a period of one (1) year. This shall include regular monthly maintenance and "On Call" service if required.
- G. For equipment bearing a manufacturer's warranty in excess of one year, furnish a copy of the warranty to the Owner, who shall be named as beneficiary.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01. COORDINATION OF TRADES

- A. Contractor shall coordinate all trades in the interest of obtaining the most practical overall arrangement of equipment, piping, conduit, and ducts and to maintain maximum headroom and accessibility.
- B. No extras will be allowed for changes made necessary by interference between trades.
- C. Submit Composite Drawings in accordance with Special Conditions. Include dimensioned plans, elevations, sections and details and give complete information particularly as to the kinds and types of materials and equipment, size and location of sleeves, inserts, attachments, chases, openings, conduits, ducts, boxes, lighting, structural interferences. Coordinate these Composite Drawings and field layouts in the field for proper relationship to work of applicable trades based on field conditions. Contractor shall have competent personnel readily available for coordinating, checking, and supervision of field layouts. The

procedures for submittals and resubmittals, and final distribution shall be as specified in Division 01. Do not start installation of work involved under Composite Drawings until the Architect reviews applicable submittal. Discrepancies between the Drawings and Composite Drawings shall be specifically noted and identified on the Composite Drawings. Drawings for the various trades involved shall be submitted as required and reviewed prior to preparation of Composite Drawings.

- 1. Equipment Foundations and Bases: Furnish certified details and drawings for approval before fabrication. Furnish parts necessary for each foundation sub base and support.
- 2. Pipe Sleeves and Inserts: Furnish and install pipe sleeves and pipe support inserts before concrete is poured.
- 3. Roof, Wall and Floor Openings: Furnish Shop Drawings showing exact locations and sizes of openings through roofs, walls and floors.
- 4. Concrete: Conform to Concrete Section of the Specifications.

3.02. PROTECTION OF EQUIPMENT AND MATERIALS

Provide adequate storage facilities for equipment and materials on the site and shall make provisions to protect such materials and equipment from damage.

3.03. CLOSING-IN OF UNINSPECTED WORK

Contractor shall not allow or cause any of the work, specifically ductwork and piping, to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Should any of work be covered up or enclosed before such inspection and test, he shall at his own expense, uncover the work and after it has been inspected, tested, and approved, make repairs with such materials as may be necessary to restore work to its original and proper condition.

3.04. BUILDING FOOTING CLEARANCES

Under no circumstances shall pipes, ducts, or conduits penetrate footings. They shall cross below footings or through sleeves above footings. Those running parallel to footings shall have the minimum clearance from the cone of influence indicated on the Drawings or as required by Code.

3.05. DAMAGE BY LEAKS

Contractor shall be responsible for all damage to any part of the premises caused by rain leaks through or around ducts or pipes, leaks or breaks in piping, equipment or fixtures furnished or installed by him for a period of one (1) year from the date of Substantial Completion.

3.06. EQUIPMENT LABELS

Equipment provided under this Section shall be provided with the manufacturer's metal identification labels attached to each individual piece of equipment showing complete performance characteristics, size, model and serial number.

3.07. PRELIMINARY OPERATION

Should the Owner request that any portion of the plant, apparatus, or equipment be operated for the Owner's beneficial use prior to the final completion and acceptance of the work, the Contractor shall conform to Beneficial Occupancy Provisions of the General Conditions. Such operation shall be under the supervision and direction of the Contractor. Such preliminary operation shall not be construed as an acceptance of any of the work.

3.08. ELECTRICAL WORK

A. Coordinate with Division 26 in making the line and low voltage electrical connections and be responsible for the operation of the equipment furnished under this section.

- B. Voltage for electrical work will be included in Division 26. However, any control wiring which is required that is not shown on the control diagram shall be as described under this Section. In the event that the Contractor chooses to provide equipment that requires extra expense in the power or control wiring, he shall pay additional electrical costs.
- C. Safety switches, starters, circuit breakers, unless provided as a portion of package equipment, and the electrical connections of mechanical equipment to the electrical power service shall be provided under Division 26.
- D. Interconnecting wiring, safety switches, relays, controllers and motor starters which are integral components of packaged equipment shall be provided as an integral part of that equipment.
- E. All interconnecting power wiring and conduits shall be provided by Division 26.
- F. Control wiring shall be provided by Division 23, unless otherwise indicated on the drawings.
- G. Conduit for control wiring shall be provided by Division 26.

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SECTION 23 05 29

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. This Section includes the following hangers and supports for mechanical system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Pipe positioning systems.
 - 8. Equipment supports.
- C. Related Sections include the following:
 - 1. Division 05 for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Division 21 Section "Fire-Suppression Piping" for pipe hangers for fire-protection piping.
 - 3. Division 23 Section "Mechanical Vibration and Seismic Controls" for vibration isolation devices.
 - 4. Division 23 Section "Pipe Expansion Fittings and Loops" for flexible pipe..
 - 5. Division 23 Section "Metal Ducts" for duct hangers and supports.

1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."
- 1.04 PERFORMANCE REQUIREMENTS
 - A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.05 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.06 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." ASME Boiler and Pressure Vessel Code: Section IX.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. ASME Boiler and Pressure Vessel Code: Section IX.

1.07 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.08 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems. Not allowed for this project.
 - 4. Pipe positioning systems.
- C. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Metal framing systems. Include Product Data for components.
 - 3. Pipe stands. Include Product Data for components.
 - 4. Equipment supports.
 - 5. Welding and brazing certificates.

1.09 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- 1.10 OPERATION AND MAINTENANCE DATA

Not required.

1.11 EXTRA MATERIALS

Not required.

1.12 RECORD DRAWINGS

Not required.

1.13 <u>WARRANTY</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.
- C. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.03 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.04 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.05 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig-minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.06 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Before Installation: Verify suitability for use in lightweight concrete or concrete slabs less than 4 inches thick with project structural engineer.

2.07 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosionresistant components to support roof-mounted piping.
 - 1. Submit: Calculations and details of each pipe stand unit.
 - 2. Available Manufacturer: MIRO Industries.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or Vshaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 1. Base: Stainless steel.
 - 2. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 3. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 1. Available Manufacturer: Portable Pipe Hangers.
 - 2. Bases: One or more plastic.
 - 3. Vertical Members: Two or more protective-coated-steel channels.
 - 4. Horizontal Member: Protective-coated-steel channel.
 - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.08 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Available Manufacturer: HOLDRITE Corp.; Hubbard Enterprises.

2.09 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, non-corrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for bare piping for noise abatement.
- F. Piping shall be concealed in chases, partitions, walls, and between floors, unless otherwise directed or specifically noted on Drawings. When penetrating wood studs, joists, and other wood members, provide such members with reinforcement steel straps of Kees Protecta-Plate.
- G. For fastening to wood ceilings, beams, or joists, furnish Grinnell figure 128 or 202 pipe hanger flange fastened with drive screws. Under wood floors, 3/8-inch hanger rods shall be hung from 2-inch x 2-inch x 1/4-inch angle clips 3 inches long, with 2 staggered 10d nails, clinched over joist.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 and larger, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8.

- 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
- 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
- 9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
- 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8.
- 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 3.
- 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 and larger.
- 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 and larger, with steel pipe base stanchion support and cast-iron floor flange.
- 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 and larger, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
- 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 - 2. Side-Beam Brackets (MSS Type 34): For sides of wooden beams.

- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- N. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- P. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Each trapeze pipe hanger requires submittal of calculations and details.
 - 2. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 3. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
 - 1. Each metal framing system requires submittal of calculations and details.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Each pipe stand in requires submittal of calculations and details.
 - 2. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 3. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 for curbs specifications.

- G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
 - 1. Each equipment support requires submittal of calculations and details.
- J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. Install building attachments. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping.
- M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- O. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood inserts.
 - 6. Insert Material: Length at least as long as protective shield.
 - 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.06 PAINTING

- A. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

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SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Vibration isolation requirements.
 - 2. Vibration-isolated equipment support bases.
 - 3. Seismic restraint systems.

1.03 DESIGN REQUIREMENTS

- A. It is the intent of this Specification to provide the necessary design for the avoidance of excessive noise or vibration in the building due to the operation of machinery or equipment, or due to interconnected piping, ductwork, or conduit and to seismically restraint piping, ductwork and equipment per the applicable codes against seismic forces in any direction.
- B. All isolators shall:
 - 1. Be provided by a single manufacturer.
 - 2. Be designed or treated for resistance to corrosion. Structural steel bases shall be cleaned of welding slag and coated with an SCAQMD compliant primer.
 - 3. Be selected to perform their function without undue stress or overloading.
 - 4. All isolators shall have a method for leveling and have a 1/4" thick ribbed neoprene acoustical pad under the spring baseplate
 - 5. Be installed in a manner to prevent the transmission of vibration to the structure. No rigid connections between rotating or oscillating equipment or piping and the building will be permitted.
 - 6. Be designed to be non-resonant with equipment forcing frequencies or support structure natural frequencies.
- C. Anchor floor mounted isolated equipment to concrete housekeeping pads of sufficient size to accommodate the anchorage of seismic restraints. Housekeeping pads shall be anchored to the structure as specified by the Structural Engineer of Record.
- D. Each fan and motor assembly shall be supported on a single structural steel frame. Flexible duct connections shall be provided at inlet and discharge ducts.
- E. Where called for in the specifications or on the drawings, all structural steel bases, including concrete pouring form bases, shall be designed and fabricated by the isolation manufacturer.
- F. Unless otherwise indicated, all equipment mounted on vibration bases shall have a minimum operating clearance of 1" between structural steel base and floor or support base beneath. The minimum operating clearance between concrete inertia bases and housekeeping pads

shall be 1 inch. Check clearance space after installation to ensure that no debris has been left to possibly short circuit isolation bases.

- G. Where necessary due to height limitations, provide height saving brackets.
- H. Design isolators for positive anchorage against uplift and overturning.
- I. Purchased and/or fabricated equipment must be designed and manufactured with provision for positive anchorage against seismic forces.
- J. Seismic restraints for pipes and ducts shall be as per the SMACNA Guidelines for seismic Restraint of Mechanical Systems.
- K. Seismic restraints for equipment shall be designed to meet the criteria of the current California Code of Regulations.

1.03 THE MANUFACTURER OF VIBRATION ISOLATION AND SEISMIC CONTROL EQUIPMENT SHALL HAVE THE FOLLOWING RESPONSIBILITIES:

- A. Determine adequate vibration isolation and seismic restraint sizes and locations.
- B. Provide piping and equipment isolation systems and seismic restraints as scheduled and/or specified.
- C. Provide installation instructions and drawings to assure proper installation and performance.

1.04 STANDARDS AND REFERENCES

- A. ASCE 19 Structural Applications of Steel Cables for Buildings; 2016.
- B. ASHRAE (HVACA) ASHRAE Handbook HVAC Applications; 2015.
- C. MFMA-4 Metal Framing Standards Publication; 2004.
- D. SMACNA (SRM) Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association; 2008.

1.05 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.06 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.07 <u>SUBMITTALS</u>

A. Provide in accordance with:

- 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data:
 - 1. Provide manufacturer's product literature documenting compliance with PART 2 PRODUCTS.

- 2. Include seismic rating documentation for each isolator and restraint component accounting for horizontal, vertical, and combined loads.
- C. Shop Drawings:
 - 1. Specific vibration isolators and seismic restraints to be utilized showing compliance with the specifications.
 - 2. Isolation frame construction for each machine including dimensions, structural member sizes, support points and restraint locations and details.
 - 3. Methods for isolation and restraint of suspended piping, ductwork, and equipment.
 - 4. Methods for guides and isolation of piping risers.
 - 5. Seismic restraint calculations signed and stamped by an engineer licensed in the State of California and experienced in the design of isolation and seismic restraint for flexibly mounted equipment.
 - 6. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.

1.08 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.11 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibrationisolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

2.02 PERFORMANCE REQUIREMENTS

- A. General:
 - 1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
 - 2. Steel springs to function without undue stress or overloading.

2.03 SEISMIC RESTRAINT SYSTEMS

- A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- B. Cable Restraints:
 - 1. Comply with ASCE 19.
 - 2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
 - 3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
 - 4. Use protective thimbles for cable loops where potential for cable damage exists.
- C. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.
- D. Comply with:
 - 1. ASHRAE (HVACA) Handbook HVAC Applications.
 - 2. SMACNA (SRM).
- E. Shall be capable of safely accepting external forces as specified in the applicable codes without failure. Restraints shall maintain equipment, duct, and piping in a captive position during an earthquake. Restraints shall not short circuit vibration isolation systems or transmit objectionable vibration or noise under normal operating conditions. Seismic restraints shall be provided on all equipment as scheduled on the drawings. Submit calculations by a California registered engineer to verify snubber capacities.
- F. Type "3500" seismic restraint shall be constructed of steel plate, concentric steel pipes, and structural members in an all welded assembly. All contact points shall be cushioned with minimum 1/4" thick resilient pad.
- G. Type "3200" seismic restraint shall be all directional type with interlocking steel members constructed of structural angle and A-36 threaded rod. All contact points shall be cushioned with minimum 1/4" thick resilient pad or bushing.
H. Type "CR" seismic restraints shall be constructed of 7x19 strand galvanized aircraft cable. Cable assembly shall come complete with minimum (2) "U" bolt clamps per end and thimbles to protect cable from chafing. Allowed loads shall be the cable breaking strength with a safety factor of three. Actual loads shall be calculated with the worst case of all load applied to one cable and anchor pattern. Cable shall be installed with 1/4" slack to prevent the transmission of vibration to the structure.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- E. Vibration Isolation Systems:
 - 1. Clean debris from beneath vibration-isolated equipment that could cause short circuiting of isolation.
 - 2. Use elastomeric grommets for attachments where required to prevent short circuiting of isolation.
 - 3. Adjust isolators to be free of isolation short circuits during normal operation.
 - 4. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.02 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. Vibration isolators must not be installed in a manner that will result in piping stress or misalignment.
- C. The structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the equipment or isolators. The isolators shall be installed without raising the equipment and frame assembly.
- D. After the entire installation is complete and under full operational load, the isolator shall be adjusted so that the load is transferred from the blocks or shims to the isolator. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.
- E. Once the equipment is in operation, install and anchor the seismic restraints with proper operating clearances as indicated on drawings.
- F. Mechanical equipment shall be isolated from the building structure by vibration isolators as scheduled on the drawings.
- G. All piping 1 1/4" and over located in mechanical equipment rooms, and for a minimum of fifty (50) feet or 100 pipe diameters whichever is greater, from connection to vibrating mechanical or electrical equipment, shall be isolated from the building structure by means of vibration isolators as identified above.
- H. All HVAC piping and vertical risers shall be isolated from the building structure by means of vibration isolators and guides.

- All piping and ductwork to be isolated shall freely pass through walls and floors without contact. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork and maintain adequate clearance around the outside surfaces. Any materials used to fill the clearance space shall be permanently flexible so that vibration will not pass through it.
- J. No rigid connections between equipment and building structure, including electrical conduit and refrigerant lines, shall be made that degrades the vibration isolation system herein specified. Inform other following trades, such as plastering, or electrical, to avoid any contact which would short-circuit the vibration isolation.
- K. Bring to the Architect's attention prior to installation any conflicts with other trades which will result in unavoidable rigid contact with equipment or piping as described herein, due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
- L. Bring to the Architect's attention any discrepancies between the specifications and field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the contractor's expense.
- M. Obtain inspection and approval of any isolation installation to be covered or enclosed, prior to such closure.
- N. Thrust restraints shall consist of spring hangers with the same deflection as specified for the spring mountings. Thrust restraints shall be attached to the fan at the centerline of air discharge opening.
- O. Correct, at no additional cost, all installations that are deemed defective in workmanship or materials.
- P. Support piping connections to equipment mounted on isolators using isolators or resilient hangers for scheduled distance.
 - 1. Up to 4 Inches Pipe Size: First three points of support.
 - 2. 5 to 8 Inches Pipe Size: First four points of support.
 - 3. 10 inches Pipe Size and Over: First six points of support.
 - 4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.03 PIPING ISOLATORS

- A. All piping except fire standpipe systems are included under this section.
- B. Isolate piping within 50 feet of rotating equipment and pressure reducing stations.
- C. The isolators shall be installed with the isolator hanger box attached to, or hung as close as possible to, approved locations on the supporting structure.
- D. The isolators shall be suspended from substantial structural members, not from slab diaphragm unless specifically permitted.
- E. Hanger rods shall be aligned to clear the hanger box.
- F. Horizontal floor supported piping shall be isolated by type "RMLS-EQ", with a minimum static deflection of 1.0 inch or the same deflection as isolated equipment to which pipe is connected, whichever is greater.
- G. Vertical riser pipe support and restraint system shall consist of type "RMS" springs and type "PG-EQ" guides. Install vertical riser guides so that clearances are maintained around

concentric pipes in the guides. Install vertical restraints on the floor location as shown on drawings.

- H. Pipe anchors, where required, shall utilize resilient pipe anchors, type "RPA" or equivalent, to avoid direct contact of piping with building.
- I. Pipe Extension and Alignment connectors: Provide connectors at pump suction and discharge, riser take offs, cooling and heating coils, and elsewhere as required to accommodate thermal expansion and misalignment.

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SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Testing, adjustment, and balancing of air systems.
 - 2. Measurement of final operating condition of HVAC systems.
 - 3. Commissioning activities.

1.03 STANDARDS AND REFERENCES

- A. AABC (NSTSB) AABC National Standards for Total System Balance, 7th Edition; 2016.
- B. ASHRAE Std 111 Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.
- C. SMACNA (TAB) HVAC Systems Testing, Adjusting and Balancing; 2002.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. The contractor shall procure the services of an independent Air Balance and Testing Agency, approved by the Engineer, which specializes in the balancing and testing of heating, ventilating, and air conditioning systems. The independent agency shall be certified and in good standing with the AABC.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to Architect.
 - 2. Submit to the Commissioning Authority.
 - 3. Submit six weeks prior to starting the testing, adjusting, and balancing work.

- 4. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with Architect and other installers to sufficiently understand the design intent for each system.
- 5. Include at least the following in the plan:
 - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Identification and types of measurement instruments to be used and their most recent calibration date.
 - d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - e. Final test report forms to be used.
 - f. Expected problems and solutions, etc.
 - g. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
 - h. Details of how TOTAL flow will be determined; for example:
 - Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
 - i. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
 - j. Confirmation of understanding of the outside air ventilation criteria under all conditions.
 - k. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
 - I. Method of checking building static and exhaust fan and/or relief damper capacity.
 - m. Time schedule for deferred or seasonal TAB work, if specified.
 - n. False loading of systems to complete TAB work, if specified.
 - o. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
 - p. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
 - q. Procedures for formal progress reports, including scope and frequency.
 - r. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Field Logs: Submit at least twice a week to the Commissioning Authority.
- E. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

- F. Progress Reports.
- G. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Submit to the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
 - 2. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 6. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
 - 7. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Architect.
 - g. Project Engineer.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

See Item 1.06 – Submittals.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

See Item 1.06 – Submittals.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
 - 3. SMACNA (TAB).
 - 4. Maintain at least one copy of the standard to be used at project site at all times.
- B. A minimum of two air balance test shall be completed for the project. One shall be completed prior to any demolition is made to test existing systems in scope of work. Second test shall begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Certified by the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.

- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.03 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.04 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
 - 1. Running log of events and issues.
 - 2. Discrepancies, deficient or uncompleted work by others.
 - 3. Contract interpretation requests.
 - 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.05 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- H. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- I. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

- J. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.02 inches negative static pressure in chemical storage rooms.
- K. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.06 COMMISSIONING

- A. Perform prerequisites prior to starting commissioning activities.
- B. Include cost for commissioning requirements in the contract price.
- C. Attend commissioning meetings scheduled by the CxA when requested. TAB will need to be present 2 weeks prior to the start of TAB to review the TAB plan/procedures and weekly/bi-weekly during the on-site TAB work.
- D. Submit the TAB plan/procedures to the CxA for review at least two weeks prior to beginning TAB work.
- E. Notify the CxA a minimum of two weeks in advance of scheduled TAB work.
- F. Where applicable, complete the Certificate(s) of Acceptance per the contract documents.
 - 1. Retain Certificate(s) of Acceptance in a 3-ring binder in an organized fashion. Binder is to remain on the job site
 - 2. Provide copies of all Certificate(s) of Acceptance to the CxA.
 - Certificate(s) of Acceptance shall be conducted by companies who are certified as a Mechanical Acceptance Test Technician employer and only completed by those employees of said company who are certified to complete the respective acceptance test.
- G. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.
- H. Participate in the Functional Performance Tests as required to achieve design intent.
- I. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.
- J. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for ____ percent of the air handlers plus a random sample equivalent to ____ percent of the final TAB report data as directed by Commissioning Authority.
 - 1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
 - 2. Use the same test instruments as used in the original TAB work.
 - 3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
 - 4. For purposes of re-check, failure is defined as follows:
 - a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
 - b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.

- c. Temperatures: Deviation of more than one-degree F.
- d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
- e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
- 5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.
- K. In the presence of the Commissioning Authority, verify that:
 - 1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
 - 2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.

3.07 <u>SCOPE</u>

- A. Test, adjust, and balance the following:
 - 1. Plumbing Pumps.
 - 2. Packaged Roof Top Heating/Cooling Units.
 - 3. Packaged Terminal Air Conditioning Units.
 - 4. Computer Room Air Conditioning Units.
 - 5. Fans.

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SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to: Duct insulation.
- C. Related requirements: Section 233100 HVAC Ducts and Casings: Glass fiber ducts.

1.03 STANDARDS AND REFERENCES

- A. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- B. ASTM B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- C. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015.
- D. ASTM C1071 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.
- E. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- F. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- G. SMACNA (DCS) HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).
- H. UL 723 Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.11 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.

C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

- 2.01 REGULATORY REQUIREMENTS
 - A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. Knauf Insulation: www.knaufinsulation.com.
 - 2. Johns Manville: www.jm.com.
 - 3. Owens Corning Corporation: www.ocbuildingspec.com.
 - 4. CertainTeed Corporation: www.certainteed.com/#sle.
- B. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

PART 3 - EXECUTION

- 3.01 EXAMINATION
 - A. Verify that ducts have been tested before applying insulation materials.
 - B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated ducts conveying air below ambient temperature:
 - 1. Finish with tape and vapor barrier jacket.
 - 2. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
- D. Insulated ducts conveying air above ambient temperature:
- E. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with calked aluminum jacket with seams located on bottom side of horizontal duct section.
- F. External Duct Insulation Application:
 - 1. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 - 2. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
- G. Duct and Plenum Liner Application:
 - 1. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
 - 2. Seal and smooth joints. Seal and coat transverse joints.

3. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.03 **R-VALUE FOR INSULATION ON DUCTS SHALL BE PER TITLE-24 REQUIREMENTS**

SECTION 23 08 00

COMMISSIONING OF HVAC

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all work, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. See Section 019113 General Commissioning Requirements for overall objectives; comply with the requirements of Section 019113.
- C. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.
- D. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.
- E. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
 - 1. Control system.
 - 2. Major and minor equipment items.
 - 3. Piping systems and equipment.
 - 4. Ductwork and accessories.
 - 5. Variable frequency drives.
 - 6. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
 - 7. Indoor Air Quality Procedures: The Commissioning Authority will coordinate; Contractor will execute; see Section 015719.
- E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.03 STANDARDS AND REFERENCES

ASHRAE Guideline 1.1 - The HVAC&R Technical Requirements for the Commissioning Process; 2007 (Errata 2012).

1.07 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.04 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.05 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. HVAC Control System Documentation: Submit detailed sequences of operation, control system drawings, and points list, as specified in Section 15940.
- C. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.
- D. DRAFT Pre-functional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
 - 1. System name.
 - 2. List of devices.
 - 3. Step-by-step procedures for testing each controller after installation, including:
 - a. Process of verifying proper hardware and wiring installation.
 - b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
 - c. Process of performing operational checks of each controlled component.
 - d. Plan and process for calibrating valve and damper actuators and all sensors.
 - e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
 - 4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has "passed" and is operating within the contract parameters.
 - 5. Description of the instrumentation required for testing.
 - 6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.
- D. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.
- E. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
 - 1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.

- 2. Full as-built set of control drawings.
- 3. Full as-built sequence of operations for each piece of equipment.
- 4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
 - a. Floor.
 - b. Room number.
 - c. Room name.
 - d. Air handler unit ID.
 - e. Reference drawing number.
 - f. Air terminal unit tag ID.
 - g. Maximum air flow rate.
- 5. Full print out of all schedules and set points after testing and acceptance of the system.
- 6. Full as-built print out of software program.
- 7. Electronic copy on disk of the entire program for this facility.
- 8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
- 9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
- 10. Control equipment component submittals, parts lists, etc.
- 11. Warranty requirements.
- 12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
- 13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
 - a. Sequences of operation.
 - b. Control drawings.
 - c. Points lists.
 - d. Controller and/or module data.
 - e. Thermostats and timers.
 - f. Sensors and DP switches.
 - g. Dampers and damper actuators.
 - h. Program setups (software program printouts).
- F. Project Record Documents:
 - 1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
 - 2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.
- G. Draft Training Plan: include:
 - 1. Follow the recommendations of ASHRAE Guideline 1.1.

- 2. Control system manufacturer's recommended training.
- 3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.
- H. Training Manuals:
 - 1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

1.06 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.07 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.08 EXTRA MATERIALS

Not required.

1.09 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.10 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

- 2.01 TEST EQUIPMENT
 - A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
 - B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments

as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.
- B. Furnish additional information requested by the Commissioning Authority.
- C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.
- D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.
- E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
 - 1. Include cost of sheaves and belts that may be required for testing, adjusting, and balancing.
- F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

3.02 INSPECTING AND TESTING - GENERAL

- A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.
- B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.
- C. Provide two-way radios for use during the testing.
- D. Damper Stroke Setup and Check:
 - 1. For all damper actuator positions checked, verify the actual position against the control system readout.
 - 2. Set fan to normal operating mode.
 - 3. Command damper closed; visually verify that damper is closed and adjust output zero signal as required.
 - 4. Command damper open; verify position is full open and adjust output signal as required.
 - 5. Command damper to a few intermediate positions.
 - 6. If actual damper position does not reasonably correspond, replace actuator.
- E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

- A. TAB: Testing, adjusting, and balancing of HVAC.
- B. Coordinate commissioning schedule with TAB schedule.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

- A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.
- B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.
- C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.
- D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
 - 1. The scope of trend logging is partially specified; trend log up to 20 percent more points than specified at no extra cost to Owner.
 - 2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.
- E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.
- F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
 - 1. Setpoint changing features and functions.
 - 2. Sensor calibrations.
- G. Demonstrate to the Commissioning Authority:
 - 1. That all specified functions and features are set up, debugged and fully operable.
 - 2. That scheduling features are fully functional and setup, including holidays.
 - 3. That all graphic screens and value readouts are completed.
 - 4. Correct date and time setting in central computer.
 - 5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
 - 6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
 - 7. Power failure and battery backup and power-up restart functions.
 - 8. Global commands features.
 - 9. Security and access codes.
 - 10. Occupant over-rides (manual, telephone, key, keypad, etc.).
 - 11. O&M schedules and alarms.
 - 12. Occupancy sensors and controls.
 - 13. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. See Section 017800 for additional requirements.
- B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.
- C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

- A. See Section 017900 for additional requirements.
- B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.
- C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.
- D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:
 - 1. HVAC Control System: 2 hours.
 - 2. Packaged Rooftop Units: 2 hours.
 - 3. Split System AC or Heat Pumps: 2 hours.
 - 4. Specialty Exhaust Fans: 2 hours.
- E. TAB Review: Instruct Owner's personnel for minimum 2 hours, after completion of TAB, on the following:
 - 1. Review final TAB report, explaining the layout and meanings of each data type.
 - 2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
 - 3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
 - 4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
 - 5. Other salient information that may be useful for facility operations, relative to TAB.
- F. HVAC Control System Training: Perform training in at least three phases:
 - 1. Phase 1 Basic Control System: Provide minimum of 8 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
 - a. This training may be held on-site or at the manufacturer's facility.

- b. If held off-site, the training may occur prior to final completion of the system installation.
- c. For off-site training, Contractor shall pay expenses of up to two attendees.
- 2. Phase 2 Integrating with HVAC Systems: Provide minimum of 8 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
 - a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
 - b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
 - c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
 - d. Every display screen, allowing time for questions.
 - e. Point database entry and modifications.
- 3. Phase 3 Post-Occupancy: Six months after occupancy conduct minimum of 8 hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.
- G. Provide the services of manufacturer representatives to assist instructors where necessary.
- H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Piping.
 - 2. Refrigerant.
 - 3. Moisture and liquid indicators.
 - 4. Valves.
 - 5. Solenoid valves.
 - 6. Expansion valves.

1.03 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
- C. Liquid Indicators:
 - 1. Use line size liquid indicators in main liquid line leaving condenser.
 - 2. If receiver is provided, install in liquid line leaving receiver.
- D. Valves:
 - 1. Use service valves on suction and discharge of compressors.
 - 2. Use gauge taps at compressor inlet and outlet.
- E. Solenoid Valves:

Use in liquid line of single or multiple evaporator systems.

1.04 STANDARDS AND REFERENCES

- A. AHRI 750 Thermostatic Refrigerant Expansion Valves; 2007.
- B. AHRI 760 Performance Rating of Solenoid Valves for Use with Volatile Refrigerants; 2007.
- C. ASHRAE Std 15 Safety Standard for Refrigeration Systems; 2013.

- D. ASME B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- E. ASME B16.26 Cast Copper Alloy Fittings for Flared Copper Tubes; 2013.
- F. ASTM B88 Standard Specification for Seamless Copper Water Tube; 2016.
- G. ASTM B88M Standard Specification for Seamless Copper Water Tube (Metric); 2016.
- H. ASTM B280 Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2016.
- I. AWS A5.8M/A5.8 Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
- J. UL 429 Electrically Operated Valves; Current Edition, Including All Revisions.

1.05 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.06 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.07 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Deliver and store piping and specialties in shipping containers with labeling in place.
- D. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- E. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

Not required.

1.11 <u>RECORD DRAWINGS</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 <u>PIPING</u>

- A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
 - 1. Fittings: ASME B16.22 wrought copper.
 - 2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
- B. Copper Tube to 7/8 inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
 - 1. Fittings: ASME B16.26 cast copper.
 - 2. Joints: Flared.
- C. Pipe Supports and Anchors:
 - 1. Conform to ASME B31.5.
 - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.

2.02 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.03 <u>VALVES</u>

- A. Service Valves:
 - 1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.04 SOLENOID VALVES

A. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi.

B. Coil Assembly: UL 429, UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color-coded lead wires, integral junction box with pilot light.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 083100.
- H. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.
- I. Refrigerant piping shall be provided with insulation. All exterior insulation shall be provided with an aluminum jacket and UV protection.

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to: Metal ductwork.

1.03 STANDARDS AND REFERENCES

- A. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- B. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- C. NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- D. NFPA 90B Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.
- E. SMACNA (DCS) HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).
- F. SMACNA (FGD) Fibrous Glass Duct Construction Standards; 2003.
- G. UL 181 Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.04 QUALITY ASSURANCE

- A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and

Samples.

- B. Product Data: Provide data for duct materials, duct liner, and duct connections.
- C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.11 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

2.02 <u>MATERIALS</u>

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.
- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
 - 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
 - 2. VOC Content: Not more than 250 g/L, excluding water.
 - 3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
- C. Flexible Ducts:
 - 1. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
 - a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
 - b. Maximum Velocity: 4000 fpm.
 - c. Temperature Range: -20 degrees F to 210 degrees F.
- D. Insulated Flexible Ducts:
 - 1. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
 - a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
 - b. Maximum Velocity: 4000 fpm.
 - c. Temperature Range: -20 degrees F to 210 degrees F.
- E. Low Pressure Supply (System with Cooling Coils): 1-inch w.g. pressure class, galvanized steel.
- F. Medium and High-Pressure Supply: 6-inch w.g. pressure class, galvanized steel.
- G. Return and Relief: 1-inch w.g. pressure class, galvanized steel.
- H. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
- I. Hanger Rod: ASTM A 36/A 36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 DUCTWORK FABRICATION

- A. Fabricate ductwork gauge in accordance with current (CMC) California Mechanical Code and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. T's, bends, and elbows: Construct according to (CMC) California Mechanical Code and SMACNA (DCS).
- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

- F. Provide standard 45-degree lateral wye takeoffs unless otherwise indicated where 90-degree conical tee connections may be used.
- G. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 DUCT MANUFACTURERS

- A. Metal-Fab, Inc: www.mtlfab.com.
- B. SEMCO Incorporated: www.semcoinc.com.
- C. United McGill Corporation: www.unitedmcgill.com.

2.05 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages,reinforcing, and sealing for operating pressures indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- D. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.
- E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- G. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- H. Use double nuts and lock washers on threaded rod supports.
- I. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.
- J. Connect diffusers or light troffer boots to low pressure ducts with 7 feet maximum length of flexible duct held in place with strap or clamp.
- K. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- L. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

3.02 <u>CLEANING</u>

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Air turning devices/extractors.
 - 2. Backdraft dampers.
 - 3. Duct access doors.
 - 4. Duct test holes.
 - 5. Flexible duct connections.
 - 6. Volume control dampers.

1.03 STANDARDS AND REFERENCES

- A. NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- B. SMACNA (DCS) HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).
- C. UL 33 Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
- D. UL 555 Standard for Fire Dampers; Current Edition, Including All Revisions.
- E. UL 555S Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.

- 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, and hardware used. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Protect dampers from damage to operating linkages and blades.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Manufacturers:
 - 1. Krueger-HVAC, Division of Air System Components; _____: www.kruegerhvac.com/#sle.
 - 2. PCI Industries, Inc; Pottorff Brand : www.portorff.com.
 - 3. Ruskin Company; _____: www.ruskin.com/#sle.

- 4. Titus HVAC, a brand of Johnson Controls; _____: www.titus-hvac.com/#sle.
- B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with worm drive mechanism with removable key operator.

2.02 BACKDRAFT DAMPERS

- A. Manufacturers:
 - 1. Louvers & Dampers, Inc, a brand of Mestek, Inc; _____: www.louversdampers.com/#sle.
 - 2. Nailor Industries, Inc; ____: www.nailor.com/#sle.
 - 3. PCI Industries, Inc; Pottorff Brand : www.portorff.com.
 - 4. Ruskin Company; _____: www.ruskin.com/#sle.
- B. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.03 DUCT ACCESS DOORS

- A. Manufacturers:
 - 1. Nailor Industries, Inc; _____: www.nailor.com/#sle.
 - 2. Ruskin Company; _____: www.ruskin.com/#sle.
 - 3. SEMCO LLC; _____: www.semcohvac.com/#sle.
 - 4. Substitutions: See Section 016000 Product Requirements.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.05 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.06 VOLUME CONTROL DAMPERS

- A. Manufacturers:
 - 1. Louvers & Dampers, Inc, a brand of Mestek, Inc; _____: www.louversdampers.com/#sle.
 - 2. Nailor Industries, Inc; ____: www.nailor.com/#sle.
 - 3. PCI Industries, Inc; Pottorff Brand : www.portorff.com.
 - 4. Ruskin Company; _____: www.ruskin.com/#sle.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
- D. Quadrants:
 - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 233100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- F. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- G. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.
SECTION 23 35 16

VEHICLE EXHAUST SYSTEM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.

1.03 ENGINEERING SPEICIFICATIONS

- A. The following bid proposal includes all engineering specifications, installation, training, service and warranty for an Emergency Vehicle Exhaust Extraction System. Any deviations from this specification must be noted. Lowest priced equipment may not be approved if not considered to be equal and not in the best interest of the end user.
 - 1. The function of the vehicle exhaust removal system will be to source capture 100% of the exhaust emissions directly at the tail pipe of the vehicle and exhaust those emissions to a specified area safely outside the building.
 - The exhaust system must not interfere with access to the vehicle, nor impede doorways/walkways/or exits that would endanger the welfare of fire personnel. Drooping loops of hose or the hose assembly touching the floor will not be permitted.
 - 3. As safety to personnel is of the utmost importance, the system shall be so designed as not to whip or fly back into quarters upon disconnection. Vehicles shall be capable of exiting quarters at normal speed without causing damage to the system or taking any portion of the hose or nozzle assembly along with the exiting vehicle.
 - 4. The fan shall automatically start prior to vehicle ignition.
 - 5. The exhaust system must move with the vehicle in a forward or reverse direction of travel and have an automatic release design without any positive locking device or air bladder that clamps or binds to the tail pipe. No system that uses the vehicles tailpipe, as a pulling force will be considered.
 - 6. The exhaust system shall utilize a minimum 6.2" diameter hose in order to insure that the exhaust system can accommodate vehicle apparatus checks; and not limited to just emergency departures. Any smaller hose does not offer the required cross sectional area considered adequate for the volume of hot exhaust fumes discharged during extended run times required during routine vehicle check procedures.
 - 7. Each bid must be accompanied by a set of detailed specifications, which describe the proposed system and equipment in the same sequence as this advertised specification for ease of comparison.
 - 8. The exhaust system shall attach directly to the tail pipe. A general room ventilation method or ceiling-mounted air cleaner shall not be accepted. Only a source capture system protects the firefighters from harmful diesel fumes.
- B. System Operation:

- 1. The auto-disconnect exhaust system shall be a 24-volt electromagnetic release type that captures 100% of the exhaust emissions directly from the tail pipe and discharges those emissions to a specific location by means of an exhaust fan. Upon emergency dispatch of the vehicle, the exhaust fan shall automatically start via pressure sensor and when alarm sounds. The exhaust fan shall remain in the "on" position for as long as any engine is running. Upon vehicle exit, the hose assembly remains connected to the tail pipe and automatically disconnects at a specified distance outside the door by de-energizing the electromagnet.
- 2. The nozzle and hose assembly shall smoothly separate from the vehicle and safely retract to the stored position ready to connect to the vehicle upon reentry. Upon disconnection, the hose assembly shall not be permitted to swing wide, swing to cross the photo eye or touch the floor, possibly endangering personnel or apparatus. The hose shall remain at the door, ready for reconnection. Once the apparatus has left the building, the fan will automatically shut down after a preset time interval. Upon return, the fan is automatically activated prior to vehicle entry and the nozzle is connected to the tail pipe in a standing position. Bending over to connect the exhaust system and expose the operator to harmful exhaust fumes is not permitted. No positive locking device or moving parts shall be permitted to be connected to the tail pipe. After the vehicle has been turned off, the fan can continues to operate for a preset time interval, normally two minutes.
- C. Scope of work:
 - 1. A licensed and insured Contractor shall furnish and install a Source Capture Emergency Vehicle Exhaust Extraction System as designed and specified for the station(s).
 - 2. The Contractor shall provide and install a centrifugal exhaust fan with capacity for all connected vehicles and sized for expansion if specified.
 - 3. The Contractor shall provide and install an automatic fan start control console. The control console and all internal components shall be UL listed and manufactured in accordance with UL standard 508A and bear the UL label.
 - 4. The Contractor shall provide and install all ductwork.
 - 5. The Contractor shall be responsible for the delivery, safe storage, and handling of the products and protect them from weather elements.

1.04 EQUIPMENT

The equipment specified herein shall be a standard product of Nederman, Incorporated or approved equal. Approved equals shall be approved in writing at least seven days before bid time by the Architect, Engineer or Owners representative.

1.05 STANDARDS AND REFERENCES

Compliance with all State and Local mechanical, electrical and building codes: California Mechanical Code (CMC), American Society of Manufacturing Engineers (ASME), National Electric Code (NEC), California Building Code (CBC), American Institute of Steel Construction (AISC), Sheet Metal and Air Conditioning Contractors National Association (SMACNA), American Society of Testing Materials (ASTM).

1.06 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.07 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.08 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Record building dimensions, note vehicle type and prepare shop drawings that include: equipment position, dimensions, sizes, weights, performance data, and also location and size of field connections.
- C. Product Data: Provide manufacturer's literature and data sheets indicating rating capacities, dimensions, weights, accessories, and electrical requirements, wiring diagrams, location and size of field connections.
- D. Provide fan curves with specified operating point clearly plotted.
- E. Submit fan sound level data for fan specified.
- F. Manufacturer's Installation, Operation and Maintenance Manual, which outlines the procedures required for system installation, start up, operation and shut down. The instructions shall include the manufacturer's name, telephone number, model number, service manual number, parts list, and brief description of all equipment and the basic operating features. The maintenance instructions shall list routine maintenance procedures, and troubleshooting guide.
- G. Certifications: International Quality System Standard ISO 9001 and ISO 14001 Certified. ISO 9001 and ISO 14001 certificates shall be submitted at bid time UL Certification: UL listing, 508A Industrial Control Panel bulletin. Compliance with: NFPA 1500, 2006 California Mechanical Code, NIOSH CIB #50, OSHA 2001 American Conference of Governmental Industrial Hygienists (ACGIH) 2002 Proposed Regulations for Benzene and Diesel Exhaust Fumes. Federal Communications Commission approvals

1.09 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.10 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.11 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.12 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.13 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 <u>PARTS</u>

- A. Suction Rail Assembly
 - 1. The Suction Rail shall be a polished aluminum extrusion that is formed in a configuration such that the extrusion serves not only as a suction duct, but also as the guide rail that the extraction trolley travels in. The wall thickness of the aluminum extrusion shall be no less than .09375". The weight of the aluminum extrusion is 4.6 lbs. per lineal foot. The area of the aluminum extrusion, in a cross-sectional view, shall have the minimum equivalent area of .2035 sq. ft. with an overall length as specified and indicated on the drawings. Each open end of the suction rail shall be covered with an end cap that can also be used as a round duct outlet for 8" diameter exhaust duct. As an alternate outlet, one or more rectangular-to-round transitions can be mounted on the top-side of the suction rail after the cutout has been made per the manufacturer's specified size. A pair of EPDM rubber seals is installed at the bottom of the extrusion opening. The rubber seals have a Teflon strip on the inside surface which enables the trolley to travel smoothly and unhindered. The rubber seals close tightly during fan operation for an airtight seal, but open evenly around the trolley during trolley travel. The suction rail shall be supplied with internal rubber bumpers installed at both ends that serve as secondary stops to the trolley. The suction rail shall be supplied with suspension attachments that are specifically designed for fastening to the configuration of the suction rail. Spacing of the suspension attachments shall not exceed 16 feet center-to-center.
- B. Extraction Trolley Assembly
 - The Extraction Trolley Assembly serves as the component in the Rail System that travels in the suction rail, carries and supports the vertical hose assembly, balances, current collectors, shock absorber and trolley stop mechanism. The Extraction Trolley body shall be made of light weight composite with a low friction surface on each side to enable the trolley to travel smooth through the rubber seal. Also, on a formed bracket mounted to the composite body, shall be a Disconnection box, acting as a circuit breaker for the Electro Magnet. The rail design must be capable of handling up to 4 vehicles parked in tandem.

C. Balancer

1. Integrated to the Extraction Trolley Assembly is a Balancer. The adjustable tension Balancer shall retract the hose and nozzle away from the vehicle as it leaves the building and safely suspend the assembly off the floor in the storage position when not in use. The Balancer shall have a spring characteristics that ensure that the cord is wound onto the drum at a safe and constant speed.

- D. Vertical Hose
 - 1. The Upper Vertical Suction Hose shall be 6.2" in diameter, and of suitable flexibility to have a compression ratio of minimum 8:1. The hose material shall be Trevira fabric covered with HYPALON (CSM, Chloro-sulfonated polyethylene). The hose shall be fire resistant according to DIN 4102 B1. The lower hose shall be designed to withstand a 500oF engine temperature in conjunction with induced ambient air for cooling. The hose shall be capable of withstanding temperatures of 340 degrees Fahrenheit continuously, up to 370 degrees Fahrenheit on an intermittent usage basis. (NOTE: If a 'closed type sealed system' is being used, the temperature ratings must be 680°F and 740°F respectively.) (Exhaust hoses that are laminated neoprene- coated polypropylene fabric with wire helix structure shall not be accepted.) The helix shall be external and made of aluminum. The helix shall have high flexibility and the fabric able to withstand oil, chemical, ozone and weather resistance.

E. Nozzle

- 1. The Nozzle shall be a minimum of 8" diameter and designed to capture 100% of the vehicle exhaust fumes generated at the vehicle tail pipe and is held in place by spring tension in conjunction with the electromagnet connection. The nozzle permits an ambient air mix in the air stream to immediately reduce exhaust emission temperatures up to 50% at the point of capture. The reduced air stream temperatures prolong component life by not permitting thermal breakdown of materials. The Nozzle shall be designed so as not to cause or create back pressure on any vehicle engine, nor draw raw diesel- or gasoline fumes into the exhaust hose while connected to a non-operating vehicle, nor create the possibility of spinning a non-lubricated turbo which could result in bearing failure. In a 'closed type sealed system', a pressurized container is created presenting an explosive potential when drawing raw fumes from a non- operating vehicle and all system electrical components must be of explosion proof design. No closed system will be considered. These conditions are non-existent with an ambient air mix nozzle design.
- 2. The operator never has to touch the Nozzle for connection, but can position the Nozzle over the tail pipe while the operator grips the hose handle and simultaneously connects the electromagnet to the anchor plate. Tension will be automatically applied to the Nozzle created by an internal leaf spring assembly, which holds the Nozzle firmly in place over the tail pipe. The positioning of the electromagnet on the vehicle, combined with the tension created at the Nozzle, shall not allow the Nozzle to come away from the tail pipe until the electromagnet is either automatically or manually deenergized. The Nozzle shall be constructed of both metal and rubber, with no internal movable parts related to the connection of the Nozzle to the tail pipe. The Nozzle Hose shall be a minimum of 6.2" in diameter. The hose material shall be lightweight coated fiberglass with a smooth bore. The galvanized steel helix shall be completely rubber covered. The inlet diameter at the Nozzle is oversized to allow maximum airflow capacity for large engines and/or pump tests. The inlet boot of the Nozzle is to be made of EPDM rubber, and bonded to a sturdy 24 gauge steel conical reducer. The design of the nozzle shall allow for maximum flexibility to accept a variety of tail pipe configurations, which typically terminate at 90° to the side of the vehicle. Tail pipe adapters are not permitted nor required. No positive locking devices or a concept of a positive locking device, pneumatics, internal or external air hoses, wires, air bags, valves or precautionary devices for pneumatic bursting pressure shall be permitted or allowed.
- F. Electromagnet Assembly

- 1. An electromagnet shall be used as the means of keeping the nozzle and hose assembly attached to the vehicle, whether at rest or as it moves to the point of exit. The electromagnet shall be 24 volts, DC with power supplied via an insulated conductor encapsulated within the helix of the upper hose. The electromagnet assembly shall consist of a nitro carburized electromagnet disc, a manual override switch, and an anchor plate. The electromagnet disc assembly shall be slightly recessed to serve as a guide for ease of connection to the anchor plate mounted on the vehicle and serve as the energized contact point. The formed collar shall be of a smooth and rounded configuration to prevent hooking or catching on external devices of the vehicle.
- 2. A manual override switch shall be easily accessible to disconnect the hose assembly while accessing storage compartments or performing vehicle maintenance. The manual override switch shall be conveniently mounted facing the operator. The purpose of the switch shall be to manually de-energize the electromagnet, allowing the hose and nozzle assembly to come away unrestrained from the vehicle when in the parked position within the building. The 24-volt UL switch shall be surrounded and mounted in a closed cell water resistant neoprene jacket.
- 3. The Anchor Plate shall be mounted on the vehicle to allow the operator, in an upright position, to connect the electromagnet. The Anchor Plate shall have an outer circular isolated holder made of hard resilient plastic. Recessed in the center of the holder shall be a finished, Nedox treated steel disc to receive the electromagnet. The Anchor Plate shall be positioned on the vehicle in relation to the vertical and horizontal centerlines of the tail pipe outlet.
- G. Disconnection Switch
 - 1. Affixed to the Rail near the exit door, shall be a permanent magnet, which in conjunction with the disconnection box causes a 24-volt electromagnet to disconnect the hose assembly from the vehicle. The separation of the entire hose assembly from the vehicle is a one step process whereby no stress or strain is transferred from the vehicle to the exhaust hose or overhead brackets. Numerous mechanical functions to achieve nozzle separation such as valve activation, pneumatic deflation, and pulling forces to remove the nozzle from the tail pipe are not permitted. The disconnection switch shall be adjustable to create a nozzle release point at a specified distance as the vehicle exits the building either driving forward or backing out. If a proper disconnect does not occur, the electromagnet has a built-in safety disconnection feature, which releases it with a 50-pound shear force. Then the hose and nozzle assembly remains intact. With other systems utilizing a mechanical or pneumatic direct connection to the tail pipe, a breakaway system is required to prevent the entire hose assembly from leaving the building with the vehicle.
- H. End Stop
 - 1. The Rail shall be equipped with an End Stop, one for each Trolley, which is designed to stop the travel of the entire hose, nozzle, and balancer assembly. The stopping action itself must be spring cushioned to prevent the assembly from coming to an abrupt and immediate halt at an exit speed of up to 15 mph. The End Stop consists of a coiled spring hydraulic oil damper, which is located in the front end of the each Suction unit.
- I. Fan Auto-Start
 - 1. The Fan Auto-Start serves to act as a remote control for fan start up to ensure the exhaust system is always running whenever an emergency vehicle is in operation. Upon dispatch, the exhaust fan shall automatically start and be running at full rpm prior to engine start up via hardwire to SCU system for emergency calls and for tail pipe exhaust pressure sensor when vehicle turns on.. The fan stays on as long as any vehicle is in operation. Upon vehicle exit or shut down, a variable timer then

activates and the fan automatically turns off after a variable timed cycle. Upon vehicle return, the transmitter shall automatically activate the exhaust fan prior to the vehicle entering the building. The fan remains in operation until all vehicles are turned off and the timer then activates. The Control unit shall be FCC-approved and shall not interfere with radio communications garage doors or on board computers.

- J. Centrifugal Fans
 - 1. The fan shall be a direct drive centrifugal type, high pressure, single width, single inlet as required or indicated. Impeller wheels shall be of a modified radial tip design, with top forward curve and airfoil thickness configuration characteristics. Impeller wheels shall be spark resistant and made of aluminum to prevent static electricity build up. The impeller shall be dynamically and static balanced, and of the non-overloading type to provide maximum efficiency while achieving quiet, vibrations free operation. The fan housing shall be manufactured from cast aluminum. The fan and motor assembly shall be mounted on a galvanized steel frame, which shall protect the motor, while also serving as a mounting platform for field installation.
 - 2. For fans 5 HP and larger, centrifugal fans shall be fully enclosed, single-width, singleinlet steel construction as required or indicated. Impeller wheels shall have backward inclined or backward curved blades of the non-overloading type. The bearings shall be self-aligned ball bearing type permanently sealed and lubricated. Fan shafts shall be steel and rotate in a non-sparking aluminum rubbing ring. Fans shall be accurately finished, and shall be provided with key and key seats for impeller hubs and fan pulleys. The fans shall be furnished with factory finish protective weather coating and a drain kit. The motor shall be totally enclosed fan cooled (TEFC). Motor starters shall be magnetic with general-purpose enclosures. The fan shall be structurally supported and provided with vibration isolators as specified to ensure quiet and smooth operation. The exhaust discharge outlet shall be in compliance with ACGIH recommendations and EPA requirements. Air intakes, windows, cascade systems, prevailing currents, communications equipment and building aesthetics will be considered in the final location of the fan. Exhaust filtration systems will be provided upon request and silencers will be provided when needed. All fans are tested in accordance with AMCA Standards in an AMCA approved test facility.
- K. Air Flow Performance
 - 1. Fan capacity shall be sized as such as to deliver a minimum of 700 cfm (or as otherwise specified) at each hose drop to the vehicle being served. The exhaust system shall pull exhaust into the nozzle also inducing ambient air. The system shall be designed entirely for a negative pressure vacuum method of exhaust extraction. At no point in exhaust system will ducting be under positive pressure. Exhaust system hose drops shall be sized to maintain equal or larger cross sectional diameters than vehicle tailpipe. Exhaust systems, which do not size hose drops in accord with the vehicle engine capacity, as well as vehicle tailpipe diameter, shall not be accepted. The purpose of this portion of the specification is to insure that the exhaust system is designed to cool down exhaust as they are conveyed to the outside of fire station. This type of exhaust extraction keeps exhaust temperatures well below their designed temperature tolerances. This also prevents thermal break down of hose material thus adding years to system life. Exhaust systems that size exhaust drops without dilution ventilation and also down size the exhaust connection hose, unnecessarily put the vehicle engine warranty at risk. The delivered volume shall take into account all lengths of ductwork, elbows, and branches, shut off, wyes, etc., which accumulate the static pressure at the fan inlet. Manufacturer
- 2.02 DUCT SYSTEM
 - A. Duct Work

 Ducts, unless otherwise specified or approved, shall be round and conform to the dimensions as shown on the drawings. Ducts shall be straight and smooth on the inside with airtight joints. Wherever ducts are used with crimped ends, the joint shall have crimp and bead arrangement. The bead shall provide a rigid stop for the mating open end to seat. Ducts shall be constructed of galvanized steel and sealed in accordance with standard SMACNA methods, for the system designed negative pressure in inches w.g. All duct joints to sealed and air tight.

B. Duct Fittings

 Reducing fittings shall have a minimum of 1" graduating increase in diameter per 8" in length. Elbows up to 12" in diameter shall have a centerline radius of not less than 1.5 times the diameter. Elbows beyond 12" in diameter shall have a centerline radius of not less than 2.5 times the diameter. Branches shall enter the mains at a specified angle of not less than 30° with the centerline of the main duct in the direction of airflow, unless otherwise indicated or approved. Flexible connections to the main or branch duct shall be braced with approved metal straps or members.

C. Connections

- 1. Where duct of dissimilar metals are connected, or where sheet metal connections are made to fan inlet and outlet, only an approved fireproof flexible connection shall be used. The connection shall be installed and securely fastened by zinc coated steel clinch type draw bands for round ducts.
- D. Framed Openings and Duct Sleeves
 - 1. Duct sleeves shall be provided for all round ducts <15" diameter that pass through floors, walls, ceilings, or roofs. Sleeves in non-load bearing walls shall be fabricated of 20-gauge steel conforming to ASTM A 525. Sleeves in load bearing walls shall be fabricated of standard weight galvanized steel pipe conforming to ASTM A 53. Collars for round ducts <15" shall be fabricated from 20 gauge galvanized steel. Round ducts >15" in diameter passing through floors, walls, ceilings, or roofs shall be installed through framed openings. Structural steel members for framed openings shall conform to ASTM A 36. Framed openings shall provide a 1" clearance between the duct and the opening. A closure collar of galvanized steel ? 4" wide shall be provided on each side of the walls or floors where sleeves or framed openings are provided.
- E. Stackhead
 - 1. The exhaust discharge stack head will be a no loss type as recommended by ACGIH or as otherwise specified. The stack head design will protect against weather elements or introduction of debris.
- F. Duct Test Holes
 - 1. 1. Test holes with covers shall be provided where indicated or directed, in the duct and plenum to insert Pitot tubes to take air measurements for balancing the air moving system if required.

2.03 <u>2.2 INSTALLATION</u>

- A. Exhaust System
 - 1. The exhaust removal system shall be installed as indicated and recommended by the manufacturer. Welding and brazing shall conform to ASME-17. Slip joints shall be sealed. Riser duct shall be supported to the structure as indicated on the drawings. Main duct shall be attached to building structural members.
- B. Building Surface Penetrations

- 1. All penetrations shall be sealed. Sleeves or framed openings shall be utilized where duct penetrates building surfaces. The space between the sleeve or framed opening and the duct shall be packed with mineral wool or approved material. Closure collars shall be installed around the duct on both sides of the penetrated surface. Collars shall fit tight against the building surfaces and snug around the duct.
- C. Guide Track
 - Installation height of Guide Track shall be between 10' to 16' range or as otherwise indicated on the drawings. The Guide Track shall be installed approximately 14" from the side of the vehicle and > 12" away from the side edge of the exit door. The Guide Track for the exhaust system shall include corrosion resistant brackets for ease of mounting to structural channel, trusses, or angle iron. Brackets shall be a minimum of 0.125" thickness. Mounting bolts to be no less than 0.375" diameter (structural grade 8) for connection to steel frame. Bolts required for masonry installation shall be 0.5" x 3.5" expansion bolts, or 0.375" x 4" sleeve anchors for wall mount masonry connection. Recommendation: Unistrut 1 5/8" or Angle Iron 2"x 2"x 3/16".

D. Test

- Each exhaust system and inlet shall be balanced to produce the indicated air quantities within 10 percent at the conditions shown. Any fans with bearings shall be lubricated, and the speed, direction and rotation of each fan shall be checked and verified as running correctly. The running current of each motor shall be checked and verified as correct. Upon completion and prior acceptance of the installation, the exhaust system shall be tested at the operating conditions to demonstrate satisfactory functional and operating efficiency. The Contractor shall provide all instruments, facilities, and labor required to properly conduct the tests.
- E. Training
 - 1. The Contractor, or authorized approved personnel, shall provide training to the Owner (or appointed representative) in the daily use of and maintenance of the vehicle exhaust removal system installed and specified herein.

F. Quality Assurance

- 1. All workmanship, manufacturing procedures, airflow design, and materials shall be tested and performance guaranteed.
- G. Equipment Warranty
 - 1. The Contractor shall guarantee all materials, equipment and workmanship for a period of three (3) year from date of final acceptance of the complete job, against original defects of material and workmanship, or excessive wear or deterioration.

END OF SECTION

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SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.

1.03 STANDARDS AND REFERENCES

- A. AMCA 500-L Laboratory Methods of Testing Louvers for Rating; 2012.
- B. ARI 890 Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute; 2008.
- C. ASHRAE Std 70 Method of Testing the Performance of Air Outlets and Inlets; 2006 (R2011).
- D. SMACNA (DCS) HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

1.04 <u>QUALITY ASSURANCE</u>

Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Krueger: www.krueger-hvac.com.
- B. Price Industries: www.price-hvac.com.
- C. Titus: www.titus-hvac.com.

2.02 RECTANGULAR CEILING DIFFUSERS

- A. Type: Provide square, stamped, multi-core, square, adjustable pattern, stamped, multi-core, square and rectangular, multi-louvered, square and rectangular, adjustable pattern, multi-louvered, and ______ diffuser to discharge air in 360 degree, one way, two way, three way, four way, and ______ pattern with sectorizing baffles where indicated.
- B. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.
- C. Fabrication: Aluminum with baked enamel off-white finish.

2.03 CEILING SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
- C. Fabrication: Aluminum extrusions with factory off-white enamel finish.
- D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.04 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting.
- C. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

3.02 SCHEDULES SHOWN ON SHEET M0.1

END OF SECTION

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SECTION 23 74 13

PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Packaged roof top unit.
 - 2. Unit controls.
 - 3. Roof mounting curb and base.
 - 4. Maintenance service.

1.03 STANDARDS AND REFERENCES

- A. AHRI 210/240 Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.
- B. NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- C. ASHRAE 90.1 Efficiency Standards
- D. Unit shall be UL Tested and Certified

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

- C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Provide a five year warranty to include coverage for refrigeration compressors. Provide one year warranty on other parts within unit.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp: www.carrier.com.
- B. Trane, a brand of Ingersoll Rand: www.trane.com.

- C. York International Corporation/Johnson Controls Inc: www.johnsoncontrols.com.
- D. Lennox Commercial: www.lennoxcommercial.com

2.02 MANUFACTURED UNITS

- A. General: Roof mounted units having gas burner and electric refrigeration.
- B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, return fan, heat exchanger and burner, heat recovery coil, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.
- C. Disconnect Switch: To be provided and installed by electrical contractor.

2.03 FABRICATION

- A. Cabinet: Galvanized steel bonderized and coated with baked enamel finish on all externally exposed surfaces, including access panels with screwdriver operated flush cam type fasteners. Structural members shall be minimum 18 gage, 0.0478 inch, with access doors or panels of minimum 20 gage, 0.0359 inch.
- B. Evaporator fan cabinet interior shall be insulated with a minimum .5-in. thick, 1 lb. density, flexible fiberglass insulation. Insulation shall conform to AHRI 210/240 or 340/360 minimum exterior sweat criteria. Gas heat compartment shall use aluminum foil face fiberglass insulation.
- C. Cabinet panels shall be easily removable for servicing, and shall have molded composite handles.
- D. Unit shall have a factory-installed, sloped condensate drain pan made of a non-corrosive material, providing a minimum 3/4-in. connection with both vertical and horizontal drains and shall comply with ASHRAE 62
- E. Air Filters: Media with extended surface media filters with wire back face. Filters face velocity shall not exceed 300 FPM.
- F. Thermostatic expansion valve shall be standard
- G. Service gage connections on suction and liquid lines. Include a gauge line access port in the top of the RTU to facilitate correct and accurate condenser pressure readings with the access panels in place.
- H. Filter drier
- Roof Curb: 16 gauge formed galvanized steel with wood nailed strip and capable of supporting entire unit weight. Supply and return air openings shall be as shown on the contract drawings. Curb shall be structurally-calculated and meet the seismic requirements of the current California Building Code (CBC). Include calculations signed and stamped by a licensed California structural engineer. Provide unit hold-downs

2.04 HEATING SECTION

- A. Induced draft combustion type with energy saving direct spark ignition system, redundant main gas valve, and low-NOX compliant. Heat exchanger shall be an induced draft design. Positive pressure designs shall not be acceptable
- B. The heat exchanger shall be controlled by an integrated gas controller (IGC) microprocessor. The IGC board shall notify users of fault using an LED (light-emitting diode) to provide diagnostic information. The LED shall be visible without removing the control box access panel.
- C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, deenergize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

- D. The heat exchanger shall be constructed of 20 gauge 409 stainless steel and shall have a 15-year warranty
- E. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, with provisions for continuous fan operation.

2.05 EVAPORATOR COIL

- A. Evaporator coils shall have aluminum plate fins mechanically bonded to enhanced copper tubes with all joints brazed.
- B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.06 <u>COMPRESSOR</u>

- A. Provide hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.
- B. Factory rubber shock mounted for vibration isolation.
- C. Warranty for compressor shall be 5 years

2.07 CONDENSER COIL

- A. Provide copper tube aluminum fin coil assembly mechanically bonded to enhanced copper tubes with all joints brazed with subcooling rows and coil guard.
- B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.
- C. Provide refrigerant pressure switches to cycle condenser fans.

2.08 MIXED AIR CASING

- A. Dampers: Provide remote controlled outside and return air dampers with damper operator and remote CO2 sensor for adjusting outside air quantity.
- B. Gaskets: Provide tight fitting dampers with edge gaskets.
- C. Damper Operator: Pneumatic piston or gear driven type with spring return and pilot positioner.
- D. Mixed Air Controls: Maintain selected supply air temperature and return dampers to minimum position on call for heating and above 75 degrees F ambient, or when ambient air temperature exceeds return air temperature.

2.09 CONTROLS

- A. Shall be complete with self-contained low-voltage control circuit protected by a fuse on the 24V transformer
- B. Low ambient controls down to 35 F.

2.10 SAFETIES

- A. Compressor over temperature, over current
- B. Loss of charge/low pressure switch
- C. Evaporator coil freeze protection thermostat
- D. High Pressure switch
- E. High temperature limit switches, induced draft motor speed sensor, flame rollout switch, flame proving controls for heating section

2.11 <u>MOTORS</u>

- A. Compressor motors shall be cooled by refrigerant passing through motor windings and shall have line break thermal and current overload protection.
- B. Indoor blower (evaporator-fan) motor shall have permanently lubricated bearings and inherent automatic-reset thermal overload protection. Include direct or belt drive as shown on the equipment schedule
- C. Condenser-fan motor shall have permanently lubricated bearings and inherent automaticreset thermal overload protection.
- D. Induced draft motor shall have permanently lubricated, sealed bearings and inherent automatic reset thermal overload protection.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that proper power supply is available.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NFPA 90A.
- C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.03 SYSTEM STARTUP

A. Prepare and start equipment. Adjust for proper operation.

3.04 CLOSEOUT ACTIVITIES

A. Demonstrate operation to Owner's maintenance personnel.

3.05 MAINTENANCE

- A. Provide service and maintenance of packaged roof top units for one year year from Date of Substantial Completion.
- B. Provide routine maintenance service with a two month interval as maximum time period between calls.
- C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of six filter replacements, minimum of one fan belt replacement, and controls check-out, adjustments, and recalibration.
- D. After each service call, submit copy of service call work order or report that includes description of work performed.

END OF SECTION

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SECTION 23 74 33

DEDICATED OUTDOOR AIR UNITS

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.01 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Direct fired make-up air heater.
 - 2. Evaporative Cooling section.
 - 3. Controls.

1.02 STANDARDS AND REFERENCES

- A. ASHRAE Std 90.2 Energy-Efficient Design of Low-Rise Residential Buildings; 2007, Including All Addenda.
- B. NFPA 54 National Fuel Gas Code; 2015.
- C. NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

1.03 REGULATORY REQUIREMENTS

- A. Conform to requirements of authorities having jurisdiction.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.04 QUALITY ASSURANCE

Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Greenheck; _____: www.greenheck.com/#sle.
- B. Reznor.

2.02 FABRICATION

- A. Casing and Components: Steel panels, 18 gage, 0.0478 reinforced with structural angles and channels to ensure rigidity; access panels to burner and blower motor assemblies from either side of unit.
- B. Observation Port: On burner section for observing main and pilot flames.
- C. Insulation: Neoprene faced glass fiber insulation 1 inch thick on inlet components to burner profile plate.
- D. Finish: Heat resistant baked enamel.
- E. Outdoor Installation: Weatherproofed casing, with intake louver or hood.

- 2.03 <u>FILTERS</u>
 - A. Filter: Removable 2 inches thick high velocity permanent filters in metal frames.
- 2.04 <u>FAN</u>
 - A. Fan: Statically and dynamically balanced centrifugal fan mounted on solid steel shaft with heavy duty self-aligning pre-lubricated ball bearings and V-belt drive with matching motor sheaves and belts.
 - B. Electrical Characteristics:
- 2.05 CONTROLS SEE DETAIL #13 ON SHEET M-3.3

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install to NFPA 90A.
- C. Provide flexible duct connections on inlet and outlet from unit; refer to Section 233300.
- 3.02 SCHEDULES SEE SHEET M-0.1

END OF SECTION

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SECTION 23 81 19

SELF-CONTAINED AIR-CONDITIONERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Packaged terminal heat pump units.
 - 2. Wall sleeves.
 - 3. Louvers.
 - 4. Controls.

1.03 STANDARDS AND REFERENCES

AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide drawings indicating dimensions, rough-in connections, and electrical characteristics and connection requirements.

- C. Manufacturer's Instructions: Include assembly instructions, support details, connection requirements, and start-up instructions.
- D. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
- E. Operation and Maintenance Data: Provide maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Protect finished cabinets from physical damage by leaving factory packing cases in place before installation and providing temporary covers after installation.

1.08 OPERATION AND MAINTENANCE DATA

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 - EXECUTION

NOT USED

PART 3 - EXECUTION

2.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate installation of units with architectural, mechanical, and electrical work.

END OF SECTION

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SECTION 26 00 10

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.
- C. Equipment Safety: All electrical materials and equipment shall be new and shall be listed by Underwriter's Laboratories and bear their label, or listed and certified by a nationally recognized testing authority where UL does not have an approval. Custom made equipment must have complete test data submitted by the manufacturer attesting to its safety.
- D. Codes and Regulations:
 - 1. Design, manufacturer, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications or standard rules of the following:
 - a. Institute of Electrical and Electronic Engineers IEEE
 - b. National Electrical Manufacturers' Association NEMA
 - c. Underwriters' Laboratories, Inc. UL
 - d. National Fire Protection Association NFPA
 - e. American Society for Testing and Materials ASTM
 - f. American National Standards Institute ANSI
 - g. California Electrical Code CEC, Title 24, Part 3
 - h. California Code of Regulations, Title 8, Subchapter 5
 - i. California Building Code-CBC, Title 24 Parts 1 &2
 - j. State & Municipal Codes in Force in the Specific Project Area
 - k. Occupational Safety & Health Administration OSHA
 - I. California State Fire Marshal
 - m. California Fire Code- CFC, Title 24 Part 9
 - n. National Electrical Testing Association NETA
 - 2. The term "Code", when used within the specifications, shall refer to the Publications, Standards, ordinances and codes, listed above. In the case where the codes have different levels of requirements the most stringent rules shall apply.
- E. Requirements of Regulatory Agencies:
 - 1. Codes, Permits, and Fees: Where the Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply. The most stringent condition shall be as interpreted by the Engineer.
 - 2. Comply with all requirements for permits, licenses, fees and Code. Permits, licenses, fees, inspections and arrangements required for the Contractor at his expense shall obtain the Work, unless otherwise specified.

- 3. Comply with the requirements of the applicable utility companies serving the Project. Make all arrangements with the utility companies for proper coordination of the Work.
- F. Utility Service:
 - 1. Contractor shall verify the locations shown on the drawings and shall include extensions of lines to building service from locations which are acceptable to the Owner.
 - 2. Verify electrical, civil, architectural and structural, dimensional and other requirements with the Owner.
 - 3. Should any major modifications to the work indicated be necessary to comply with the Owner requirements, notify the Architect.
 - 4. Contractor shall contact the utility company representatives to establish preconstruction coordination, obtain all necessary meters and/or approvals, and schedule utility work to coordinate with the construction schedule.
 - 5. All utility services shall be installed per the utility company requirements. Verify final construction requirements with utility company service planners prior to construction.
- G. Work Responsibilities:
 - 1. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets, junction boxes and equipment and are to be followed. Execute the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations. The Contractor is responsible for the correct placing of his work. Where conflicts occur in plans and/or specifications, the most stringent application shall apply and shall be part of the base bid.
 - 2. Locations shown on architectural plan or on wall elevations shall take precedence over electrical plan locations, but where a major conflict is evident, notify the Architect.
 - 3. In the event minor changes in the indicated locations or arrangement are necessary due to developed conditions in the building construction or rearrangement of furnishings or equipment or due to interference with other trades, such changes shall be made without extra cost.
 - 4. Verify dimensions and the correct location of Owner-Furnished equipment before proceeding with the roughing-in of connections.
 - 5. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with work carefully check and verify dimensions and sizes with the drawings to see that the furnished equipment will fit into the spaces provided without violation of applicable Codes.
 - 6. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Architect.
 - 7. Contractor shall be responsible for coordination of coordinated drawings when required by the Architect.
 - 8. Replace or repair, without additional compensation any work which does not comply with or which is installed in violation of any of these requirements.

1.02 SCOPE OF WORK SUMMARY

A. Work included: Furnish all labor, material, tools, equipment, facilities, transportation, skilled supervision necessary for, and incidental to, performing operations in connection with furnishing, delivery, and installation of the work in this division complete as shown or noted on the Drawings and specified herein.

- B. This section supplements all sections of this division and shall apply to all phases of work hereinafter specified, shown on the drawings, or required to provide a complete installation of electrical systems for the Project. The work required under this division is not limited to the electrical specifications and drawings. Refer to all bid documents including Civil, Architectural, Structural, and Mechanical documents which may designate Work to be accomplished. The intent of the Specifications is to provide a complete and operable electrical system, which shall include all documents that are a part of the entire Project Contract.
- C. Work Installed but Furnished by Others:

The electrical work includes the installation or connection of certain materials and equipment furnished by others. Verify installation details. Foundations for apparatus and equipment will be furnished by others unless otherwise noted or detailed.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Standard of Quality:
 - The contract Drawings and Specifications establish the "MINIMUM STANDARD OF QUALITY" each product and/or system must meet to be considered acceptable. Products of other manufactures will be considered if the product and/or system meet or exceed the "MINIMUM STANDARD OF QUALITY" established by this Contract Document.
 - 2. Items for similar application shall be of the same manufacturer.
 - 3. The label of listing by UL shall appear on all materials and equipment for which standards have been established by the agency.
 - 4. Where codes as listed in Section General Requirement Section of the Specifications that establish label or approved requirements, furnish all materials and equipment with either the required labels affixed or the necessary written approval.
 - 5. Provide the type and quantity of electrical materials and equipment necessary to complete Work and all systems in operation, tested and ready for use.
 - 6. Provide and install all incidental items that belong to the Work described and which are required for complete systems.
 - 7. All switchboards, distribution boards, panel boards and circuit breakers shall be of the same manufacturer.
 - 8. All wiring devices such as switches and receptacles shall be of the same manufacturer.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

A. Provide in accordance with:

- 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Shop Drawings:
 - 1. Time Schedules for Submission and Ordering: The Contractor shall prepare, review and coordinate his schedule of submissions carefully, determining the necessary lead time for preparing, submitting, checking, ordering and delivery of materials and equipment for timely arrival. The Contractor shall be responsible for conformance with the overall construction schedule.
 - 2. Submittals will be checked for general compliance with specifications only. The Contractor shall be responsible for deviations from the drawings or specifications and for errors or omissions of any sort in submittals.
 - 3. Submit a complete list of materials and equipment proposed for the job, including manufacturers names and catalog numbers.
 - 4. Shop drawings shall be submitted in completed groups of materials (i.e., lighting fixtures or switchgear). The Contractor shall add and sign the following paragraph on equipment and materials submitted for review. "It is hereby certified that the (equipment) (material) shown and marked in this submittal is that proposed to be incorporated into the project; is in compliance with the Contract Drawings and specifications and can be installed in the allocated spaces". Failure to add the above written statement for compliance will result in return of submittals without review.
 - a. Bind catalog cuts, plate numbers, descriptive bulletins and drawings, 11" x 17" (275 mm x 435 mm) or smaller, in sets with covers neatly showing titles.
 - b. The Contractor shall verify dimensions of equipment and be satisfied as to Code compliance for fit prior to submitting shop drawings for approval.
 - c. Where current limiting devices are specified, submit technical data to substantiate adequate protection of equipment cascaded downstream.
 Submittals shall not be reviewed unless supporting calculations and data are submitted therewith.
 - d. Include complete catalog information such as construction, ratings, insulation systems, as applicable.
 - e. For any material specified to meet UL or trade standards, furnish the manufacturers or vendor's certification that the material furnished for the work does in fact equal or exceed such specifications.
 - f. Reference listings to the specifications' Sections and Article to which each is applicable.
 - g. Equipment Floor Plans: After approval of material is secured prepare a floor plan of each electrical and communication equipment space, room or yard, drawn to scale at 1/2 inch equals 1 foot and submit for approval in the same manner as for shop drawings. The layout drawings shall be exact scale.
- C. Submit comprehensive material list, shop drawings and complete technical data for the following equipment and materials:
 - 1. Main service and distribution switchboards.
 - 2. Panelboards.
 - 3. Conduits

- 4. Conductors, include all selected insulation types.
- 5. Fuses
- 6. Disconnect switches and Starters.
- 7. Pullboxes, manholes and handholes.
- 8. Standard lighting fixtures, specially fabricated fixtures, ballasts and lamps, with samples and sample of standard finish available (where requested).
- 9. Control devices, standard and special receptacles, switches, outlets and finish device plates.
- 10. Cabinets for signal and telephone system, special terminals and cabinets. Include all cabinet dimensions.
- 11. Fire alarm system.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 <u>RECORD DRAWINGS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
 - 2. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
 - 3. Project Manual Volume Four, Section 01 78 39 Project Record Documents.
- B. Record Drawings: CAD: Use a computer aided drafting (CAD) system in the preparation of record drawings for this Project. Acceptable CAD systems shall be capable of producing files in AutoCAD Version 2004 compatible DWG or DXF format. Owner's consultant will furnish CAD backgrounds for use by the Contractor after construction is 85% complete except where prohibited by Contract.
- C. Record Set During the Work: At site, maintain at least one set of Drawings as a Field Record Set. Also maintain at least one copy of all Addenda, Modifications, approved submittals, correspondence, and transmittals at site. Keep Drawings and data in good order and readily available to Architect and Owner.
- D. Changes: Clearly and correctly mark Record Drawings to show changes made during the construction process at the time the changed work is installed. No such changes shall be made in the work unless authorized by the Architect.

- E. Preparation of Final Record Drawings: Contractor shall transfer recorded changes in the work indicated on the Field Record Set to the record set. Changes shall be neatly and clearly drawn and noted by skilled draftsmen, and shown technically correct.
- F. Approval: Prior to Architect's inspection for Substantial Completion, submit the Final Record Drawings to the Architect for review, and make such revisions as may be necessary for Final Record Drawings to be a true, complete, and accurate record of the work.
- G. Manuals: Obtain data from the various manufacturers and submit instruction, operation, and maintenance manuals as required and to the extent required under other Sections.
- H. At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies, a complete separate, clean, undamaged set of the latest stamped, actioned submittals. As work progresses, maintain records of "as installed" conditions on this set in suitable ink or chemical fluid. Update the set daily. After successful completion of Project Site testing specified herein, and after completion of Punch List corrections, copy all records of "as installed" conditions on to originals.
- I. Quantity:
 - 1. Review sets: As for Shop and Field Drawings.
 - 2. Record set: Refer to Division 01.
- J. Content: All drawings required under "Field and Shop Drawings". Show "as installed" condition. Where room designations according to Project permanent signage differ from construction designations in the Contract Documents, show both designations.

1.11 <u>WARRANTY</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
 - 2. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
 - 3. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- B. Other Conditions:
 - Except as may be specified under other Sections in the specification, guarantee equipment furnished under the specifications for a period of one year, except for equipment required to have a longer guarantee period, from date of final completion. Guarantee all work against defective workmanship, material, and improper installation. Upon notification of failure, correct deficiency immediately and without additional cost to the Owner.
 - 2. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner or his service agency as approved. Furnish to the Owner, through the Architect, printed manufacturer's warranties complete with material included and expiration dates, upon completion of project.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.01 INSTALLATION GENERAL

For special requirements, refer to specific equipment under these requirements:

- A. Unless otherwise specified elsewhere in the specifications, do all excavating necessary for the proper installation of the electrical work.
- B. Locations of Openings: Locate chases, shafts and openings required for the installation of the electrical work during framing of the structure. Do any additional cutting and patching required. Cutting or drilling in any structural member is prohibited without approval of the Architect. Furnish all access panels to make all boxes, connections and devices accessible as required by CEC.
- C. Location of Sleeves: Where conduits pass through concrete walls, suspended slabs or metal deck floors, install sleeves of adequate size to permit installation of conduit. Sleeves shall be installed prior to pouring of concrete and shall have ends flush with the wall or extend 2 inches above floor surfaces. Verify locations.
- D. Wherever conduit extends through roof, install flashings in accordance with drawings and details.
- E. Contractor shall be responsible for cutting and patching which may be required for the proper installation of the electrical work.
- F. Protect work, materials and equipment and provide adequate and proper storage facilities during the progress of the work. Storage outdoors shall be weather protected and shall include space heaters to prevent condensation. Provide for the safety and good condition of all work until final acceptance of the work. Replace all damaged or defective work, materials and equipment before requesting final acceptance.
- G. Conduit and Equipment to be Installed: Clean thoroughly to remove plaster, spattered paint, cement and dirt on both exterior and interior. All underground conduits shall be mandrelled prior to pulling wire.
- H. Conduit and Equipment to be Painted: Clean conduit exposed to view in completed structure by removing plaster and dirt. Remove grease, oil and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.
- I. Items with Factory Finish: Remove cement, plaster, grease and oil, and leave surfaces, including cracks and corners, clean and polished. Touch up scratched or bare spots to match finish.
- J. Site Cleaning: Remove from site all packing cartons, scrap materials and other rubbish on a weekly basis. Vacuum out all cabinets, switchgear and panels and junction boxes prior to pulling any conductors.
- K. Electrical equipment and materials exposed to public and in finished areas shall be finishpainted after installation in accordance with the Painting Section. All exposed screw-type fasteners, exterior, or interior in restrooms, shall be vandal-resistant spanner type; include tool.

3.02 EXCAVATION, CUTTING AND PATCHING:

A. Excavating, trenching and backfilling required for the work of this Division in accordance with the applicable requirements of Sitework. Excavating and backfilling connected with electrical

work, repaving cuts and providing and maintaining protective measures for the electrical work excavation required by the governing authorities having jurisdiction shall be performed as a part of the work of this Division.

B. Verify openings indicated on the drawings. Provide all cutting, patching and reinforcement of the construction of the building as required to install electrical work.

3.03 TESTS:

- A. Equipment and systems for which the National Electrical Testing Association (NETA) has an approved or recommended procedure, shall be tested in accordance with that procedure. Test values shall equal values recommended by NETA. Copies of test reports shall be submitted as required under shop drawing submittals.
- B. Resistance to ground tests shall be accomplished by a qualified independent testing firm to measure resistance to ground at grounding electrodes. Make tests before slabs or affected areas are poured in order that corrective measures, if required, may be taken. Submit a report showing the results of these measurements. If the resistances exceed values specified elsewhere or NETA test procedure recommendations, perform corrective measures required to reduce resistance to acceptable values.
- C. Prior to energizing any motor, measure the service voltage for phase balance and report if unbalance exceeds 1% from mean.
- D. Measure the three-phase voltage at no load and at maximum load conditions and submit to the engineer a report showing the results of these measurements.
- E. Upon completion of the work and adjustment of all equipment, conduct an operating test. Conduct the test in the presence of an authorized representative of the Owner's Representative. Demonstrate system and equipment to operate in accordance with requirements of the Contract Documents and to be free from electrical and mechanical defects. Provide systems free from short circuits and grounds and show an insulation resistance between phase conductors and ground not less than the requirements of the governing electric code. Test circuits for proper neutral connection.
- F. Complete tests prior to final inspection of project, including corrective work based on the results of the tests.
- G. Perform special tests on systems and equipment as specified herein using personnel qualified to perform such tests.

3.04 PROTECTION:

Protect finish parts of the materials and equipment against damage during the progress of the work and until final completion and acceptance. Cover materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred. Keep moving parts clean, dry and lubricated.

3.05 <u>CLEANING UP</u>:

- A. Upon completion of the work and at various time during the progress of the work, remove from the building all surplus materials, rubbish and debris resulting from the work of this Division.
- B. Thoroughly clean switchgear including busses, apparatus, exposed conduit, metal work including the exterior and interior, and accessories for the work of this Division, of cement, plaster and other deleterious materials; remove grease and oil spots with cleaning solvent; carefully wipe surfaces and scrape cracks and corners clean.
- C. Thoroughly polish chromium or plated work. Remove dirt and stains from lighting fixtures.
- D. Leave the entire installation in a clean condition.

3.06 INSPECTION AND ACCEPTANCE PROCEDURES:
The Architect will submit observation reports periodically during the construction phase detailing Contract deficiencies. The Contractor is responsible for making corrections immediately. Notice of Completion of the project will not be made until all items have been corrected.

3.07 <u>COMPLETION</u>:

- A. The work will not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, panel directories and nameplates specified herein have been approved and properly posted or installed and final cleaning of equipment and premises has been completed.
- B. When the installation is complete and adjustments have been made, operate the system for a period of one week, during which time demonstrate that systems are completed and operating in conformance with the specifications.

3.08 FINAL COMPLETION OF ELECTRICAL SYSTEMS:

- A. Prior to Final Completion of operating electrical systems, the Contractor shall:
 - 1. Provide materials of the type and quality specified and as necessary for proper operation, tested and ready for use.
 - 2. Furnish the required Operating and Maintenance Data/Manuals.
 - 3. Clean up of the project pertaining to this Division of the work.
 - 4. After installation has been completed and adjustments made, operate the system for a period of one week, during which time, demonstrate to the Architect that systems are complete and operating in conformance with Contract Documents.
 - 5. Conduct tests required and as specified in this Division and submit test reports and corrective actions taken.
 - 6. Submission of warranties and guarantees.
- B. Final Completion of Work Shall be Contingent On:
 - 1. Contractor replacing defective materials and workmanship.
 - Upon completion of work and adjustments made, Contractor shall conduct an operating test for each system for approval at such time as Architect directs. Conduct test in presence of authorized representative of Architect and demonstrate that systems and equipment do operate in accordance with requirements of the Contract Documents and are free from electrical and mechanical defects.
 - Contractor shall provide the necessary training programs and instructions to the Owner's representative. Number of hours shall be a minimum of four (4) hours for each system or days as required under separate Sections of these Specifications. Complete operation and maintenance manuals shall be provided at least two (2) weeks prior to training.
 - 4. Submit copies of manufacturer's instructions and maintenance of electrical equipment including replacement parts lists. Each set shall include one set of shop drawings of equipment installed.
 - 5. Completion of Commissioning see Part 4 of the Specification Section.

PART 4 – COMMISSIONING

4.01. <u>COMMISSIONING OF ELECTRICAL SYSTEMS</u>

- A. Include cost for commissioning requirements in the contract price.
- B. Attend commissioning meetings scheduled by the CxA.

- C. Prepare preliminary schedule for indoor lighting system inspections, O&M manual submission, training sessions, lighting controls testing, system verification, performance testing, and system completion for use by the CxA. Update schedule as appropriate throughout the construction period and provide updated schedule to the commissioning team.
- D. Verify proper installation and performance of all electrical services provided.
- E. Complete Title 24 Certificate(s) of Installation and manufacturer's pre-start checklists prior to scheduling startup of HVAC and electrical equipment.
 - 1. Retain Certificate(s) of Installation in a 3-ring binder in an organized fashion. Binder is to remain on the job site
 - 2. Make Certificate(s) of Installation available for CxA review upon request.
 - 3. Retain calibration records for equipment provided with manufacturer calibrated sensors in the Certificate(s) of Installation binder.
- F. Where applicable, complete the Certificate(s) of Acceptance per the contract documents.
 - 1. Retain Certificate(s) of Acceptance in a 3-ring binder in an organized fashion. Binder is to remain on the job site
 - 2. Provide copies of all Certificate(s) of Acceptance to the CxA.
 - Certificate(s) of Acceptance shall be conducted by companies who are certified as California Advanced Lighting Controls Training Program Acceptance Technician (CALCTP-AT) employer and only completed by those employees of said company who are certified to complete the respective acceptance test.
- G. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.
- H. Participate in the Certificate(s) of Acceptance and Functional Performance Tests as required to achieve design intent.
- I. Participate in the opposite-season testing as required to achieve design intent.
- J. Participate in O&M Training as required by project specifications.
- K. Ensure participation of major equipment manufacturers and their representatives as applicable.
- L. Obtain O&M data on all equipment and assemble in binders using tabs as required.
- M. Conduct a maintenance orientation and inspection with hands on training per the contract documents.
- N. Provide written certification and completed Certificate(s) of Installation forms and checklists documenting that the following work has been completed in accordance with the plans and specifications and that they are functioning as designed.
 - 1. Correct labeling of all circuits with connected equipment.
 - 2. Lighting system controls operations, including occupancy sensors, automatic time controls or Energy Management control, override timers, manual dimming controls, exterior lighting controls, multi-level switching, as applicable to the Work.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Single conductor building wire.
 - 2. Wiring connectors.
 - 3. Electrical tape.
 - 4. Heat shrink tubing.
 - 5. Wire pulling lubricant.
 - 6. Cable ties.
- C. Related requirements: Section 260553 Identification for Electrical Systems: Identification products and requirements.

1.03 STANDARDS AND REFERENCES

- A. ASTM B3 Standard Specification for Soft or Annealed Copper Wire; 2013.
- B. ASTM B8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.
- C. ASTM B33 Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).
- D. ASTM B787/B787M Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).
- E. ASTM D3005 Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.
- F. ASTM D4388 Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.
- G. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- H. NEMA WC 70 Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2009.
- I. NETA ATS Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- J. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 44 Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

- L. UL 83 Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- M. UL 486A-486B Wire Connectors; Current Edition, Including All Revisions.
- N. UL 486C Splicing Wire Connectors; Current Edition, Including All Revisions.
- O. UL 486D Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- P. UL 510 Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Conform to requirements of NFPA 70.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's

instructions.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 <u>WARRANTY</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is not permitted.
- E. Service entrance cable is not permitted.
- F. Armored cable is not permitted.
- G. Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide new conductors and cables manufactured not more than one year prior to installation.

- D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- E. Comply with NEMA WC 70.
- F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- H. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
- I. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
 - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
 - 2. Control Circuits: 14 AWG.
- J. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 - 3. Color Code:
 - a. 240/120 V High-Leg Delta, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B (High-Leg): Orange.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - b. 240/120 V, 1 Phase, 3 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Neutral/Grounded: White.
 - c. Equipment Ground, All Systems: Green.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

- 1. Copper Building Wire:
 - a. Cerro Wire LLC: www.cerrowire.com/#sle.
 - b. Encore Wire Corporation: www.encorewire.com/#sle.
 - c. Southwire Company: www.southwire.com/#sle.
 - d. Rome Wire and Cable.
 - e. Okonite Wire
 - f. Pirelli Wire and Cable
 - g. Carol Cable
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 - a. Size 4 AWG and Larger: Type XHHW-2.
 - b. Installed Underground: Type XHHW-2.

2.04 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- C. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 - 4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
- D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

- F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- G. Mechanical Connectors: Provide bolted type or set-screw type.
- H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.05 WIRING ACCESSORIES

- A. Electrical Tape:
 - Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
 - Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
 - 3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
 - 4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
 - 5. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
- D. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 - EXECUTION

- 3.01 EXAMINATION
 - A. Verify that interior of building has been protected from weather.
 - B. Verify that work likely to damage wire and cable has been completed.
 - C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
 - D. Verify that field measurements are as indicated.
 - E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 - 1. Unless dimensioned, circuit routing indicated is diagrammatic.

- 2. When circuit destination is indicated without specific routing, determine exact routing required.
- 3. Arrange circuiting to minimize splices.
- 4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
- 5. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
- 6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Installation in Raceway:
 - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 - 2. Pull all conductors and cables together into raceway at same time.
 - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
 - 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 - 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- G. Install conductors with a minimum of 12 inches of slack at each outlet.
- H. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- K. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

- 3. Do not remove conductor strands to facilitate insertion into connector.
- 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion. oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
- 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
- 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
 - 1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
 - 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
 - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
 - 3. Wet Locations: Use heat shrink tubing.
- M. Insulate ends of spare conductors using vinyl insulating electrical tape.
- N. Field-Applied Color Coding: Where vinvl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- O. Identify conductors and cables in accordance with Section 260553.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section Firestopping.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

FIELD QUALITY CONTROL 3.04

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
- C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Grounding and bonding requirements.
 - 2. Conductors for grounding and bonding.
 - 3. Connectors for grounding and bonding.

1.03 STANDARDS AND REFERENCES

- A. IEEE 81 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
- B. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- C. NETA ATS Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- D. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 467 Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Conform to requirements of NFPA 70.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- E. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Field quality control test reports.
- D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 25 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
- E. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 - 3. Metal In-Ground Support Structure:
 - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
 - 4. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
 - 5. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
- F. Bonding and Equipment Grounding:
 - 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing

electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

- 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
- 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
- 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
- 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
 - 1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
 - 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 - 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 - 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).

- C. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- D. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

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SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to: Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.
- C. Related requirements: Section 033000 Cast-in-Place Concrete: Concrete equipment pads.

1.03 STANDARDS AND REFERENCES

- A. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM B633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.
- D. MFMA-4 Metal Framing Standards Publication; 2004.
- E. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- F. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

C. Sequencing: Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

A. Project Manual Volume One, Sections 00710, Article 6.12 – Contractor's General Warranty and Guarantee.

- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 5 times the applied force. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 - 6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
 - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 - 2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 - 1. Comply with MFMA-4.
 - 2. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

- F. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 - 2. New Concrete: Use preset concrete inserts.
 - 3. Existing Concrete: Use expansion anchors.
 - 4. Solid or Grout-Filled Masonry: Use expansion anchors.
 - 5. Hollow Masonry: Use toggle bolts.
 - 6. Hollow Stud Walls: Use toggle bolts.
 - 7. Steel: Use welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 8. Wood: Fasten with lag screws or through bolts.
 - 9. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
 - 10. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:

- 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
- 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
- 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
- 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- I. Secure fasteners according to manufacturer's recommended torque settings.
- J. Remove temporary supports.

3.03 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete (Limited Applications)" as applicable.
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturers written instructions.

3.04 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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SECTION 26 05 33.13

CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Galvanized steel rigid metal conduit (RMC).
 - 2. PVC-coated galvanized steel rigid metal conduit (RMC).
 - 3. Flexible metal conduit (FMC).
 - 4. Liquidtight flexible metal conduit (LFMC).
 - 5. Electrical metallic tubing (EMT).
 - 6. Rigid polyvinyl chloride (PVC) conduit.
 - 7. Conduit fittings.
 - 8. Accessories.

1.03 STANDARDS AND REFERENCES

- A. ANSI C80.1 American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.
- B. ANSI C80.3 American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2015.
- C. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- D. NECA 101 Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
- E. NECA 111 Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
- F. NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- G. NEMA RN 1 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2005 (R2013).
- H. NEMA TC 2 Electrical Polyvinyl Chloride (PVC) Conduit; 2013.
- I. NEMA TC 3 Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.
- J. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 1 Flexible Metal Conduit; Current Edition, Including All Revisions.
- L. UL 6 Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- M. UL 360 Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

- N. UL 514B Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- O. UL 651 Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- P. UL 797 Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Conform to requirements of NFPA 70.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- D. Coordination:
 - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
 - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- E. Sequencing: Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Project Record Documents: Record actual routing for conduits installed underground and conduits 2 inch (53 mm) trade size and larger.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

A. Project Manual Volume One, Sections 00710, Article 6.03 - Services, Materials and

Equipment.

B. Project Manual Volume One, Sections 00800, SC-6.03.B – Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use rigid PVC conduit.
 - 2. Exterior, Direct-Buried: Use rigid PVC conduit.
 - 3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
 - 4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use PVC-coated galvanized steel rigid metal conduit elbows for bends.
 - 5. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide

supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.

- 6. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
- D. Concealed within Masonry Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- E. Concealed within Hollow Stud Walls: Use electrical metallic tubing (EMT).
- F. Concealed above Accessible Ceilings: Use electrical metallic tubing (EMT).
- G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.
- H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
 - 1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
- J. Exposed, Exterior: Use galvanized steel rigid metal conduit.
- K. Concealed, Exterior, Not Embedded in Concrete or in Contact with Earth: Use galvanized steel rigid metal conduit.
- L. Connections to Luminaires above Accessible Ceilings: Use flexible metal conduit.
 - 1. Maximum Length: 6 feet.
- M. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Maximum Length: 6 feet unless otherwise indicated.
 - 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.
- N. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

- A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4 inch (21 mm) trade size.
 - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
 - 3. Control Circuits: 1/2 inch (16 mm) trade size.
 - 4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
 - 5. Underground, Exterior: 1 inch (27 mm) trade size.

D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
 - 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40-mil.
- C. PVC-Coated Fittings:
 - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 - 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40-mil.
- D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15-mil.

2.05 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.

2.07 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20-mil.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

PART 3 - EXECUTION

- 3.01 INSTALLATION
 - A. Install products in accordance with manufacturer's instructions.
 - B. Perform work in accordance with NECA 1 (general workmanship).
 - C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
 - D. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
 - E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
 - F. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Conceal all conduits unless specifically indicated to be exposed.
 - 4. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 5. Arrange conduit to maintain adequate headroom, clearances, and access.

- 6. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
- 7. Arrange conduit to provide no more than 150 feet between pull points.
- 8. Route conduits above water and drain piping where possible.
- 9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
- 10. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
- 11. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
- 12. Group parallel conduits in the same area together on a common rack.
- G. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 - Installation above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 - 4. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 - 5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 - 6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
 - 7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
 - 8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
 - 9. Use of spring steel conduit clips for support of conduits is not permitted.
 - 10. Use of wire for support of conduits is not permitted.
- H. Connections and Terminations:
 - 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 - 2. Where two threaded conduits must be joined and neither can be rotated, use threepiece couplings or split couplings. Do not use running threads.
 - 3. Use suitable adapters where required to transition from one type of conduit to another.

- 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
- 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
- 6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
- 7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- I. Penetrations:
 - 1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 - 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 - 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 - 4. Conceal bends for conduit risers emerging above ground.
 - 5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
 - 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 - 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
 - 8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- J. Underground Installation:
 - 1. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 24 inches.
 - b. Under Slab on Grade: 12 inches to bottom of slab.
 - 2. Provide underground warning tape in accordance with Section 260553 along entire conduit length.
- K. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section Concrete with minimum concrete cover of 3 inches on all sides unless otherwise indicated.
- L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
 - 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 - 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 - 3. Where conduits are subject to earth movement by settlement or frost.

- M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
 - 1. Where conduits pass from outdoors into conditioned interior spaces.
 - 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- N. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- O. Provide grounding and bonding in accordance with Section 260526.
- P. Identify conduits in accordance with Section 260553.

3.02 FIELD QUALITY CONTROL

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- C. Correct deficiencies and replace damaged or defective conduits.

3.03 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.04 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

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SECTION 26 05 33.16

BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
 - 2. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.03 STANDARDS AND REFERENCES

- A. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 130 Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- D. NEMA OS 1 Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
- E. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- F. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 50E Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 508A Industrial Control Panels; Current Edition, Including All Revisions.
- J. UL 514A Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Conform to requirements of NFPA 70.
- C. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

- 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
- 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
- 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
- 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
- 6. Coordinate the work with other trades to preserve insulation integrity.
- 7. Coordinate the work with other trades to provide walls suitable for installation of flushmounted boxes where indicated.
- 8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for floor boxes and underground boxes/enclosures.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

A. Project Manual Volume One, Sections 00710, Article 6.12 – Record Documents.

- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 <u>BOXES</u>

- A. General Requirements:
 - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
 - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 - 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 - 3. Use suitable concrete type boxes where flush-mounted in concrete.
 - 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 - 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 - 6. Use shallow boxes where required by the type of wall construction.
 - 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 - 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 - 9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 - 10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 - 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 - 12. Minimum Box Size, Unless Otherwise Indicated:

- a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
- b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
- c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
- 13. Wall Plates: Comply with Section 262726.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger than 100 cubic inches:
 - 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 - 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - 3. Junction and Pull Boxes Larger than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels in accordance with Section Access Panels as required where approved by the Architect.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
 - 4. Locate boxes so that wall plates do not span different building finishes.
 - 5. Locate boxes so that wall plates do not cross masonry joints.
 - 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
 - 9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
- a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
- b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
- Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
- 11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
- H. Box Supports:
 - 1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 - Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
- I. Install boxes plumb and level.
- J. Flush-Mounted Boxes:
 - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- K. Install boxes as required to preserve insulation integrity.
- L. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- N. Close unused box openings.
- O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- P. Provide grounding and bonding in accordance with Section 260526.
- 3.02 <u>CLEANING</u>
 - A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.03 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Electrical identification requirements.
 - 2. Identification nameplates and labels.
 - 3. Wire and cable markers.
 - 4. Voltage markers.
 - 5. Underground warning tape.
 - 6. Warning signs and labels.
- C. Related requirements:
 - Section 26 05 19 Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
 - 2. Section 26 27 26 Wiring Devices Lutron: Device and wallplate finishes; factory pre-marked wallplates.

1.03 STANDARDS AND REFERENCES

- A. ANSI Z535.2 American National Standard for Environmental and Facility Safety Signs; 2011.
- B. ANSI Z535.4 American National Standard for Product Safety Signs and Labels; 2011.
- C. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 70E Standard for Electrical Safety in the Workplace; 2015.
- E. UL 969 Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Conform to requirements of NFPA 70.
- C. Coordination:

Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

- D. Sequencing:
 - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 FIELD CONDITIONS

Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.11 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchboards:
 - 1) Identify ampere rating and name.
 - 2) Identify voltage and phase.
 - Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify main overcurrent protective device.
 - 5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
 - b. Panelboards:
 - 1) Identify ampere rating and name.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
 - c. Transformers:
 - 1) Identify kVA rating and name.
 - 2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - 3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
 - a. Service equipment.
 - b. Industrial control panels.

- c. Motor control centers.
- d. Elevator control panels.
- e. Industrial machinery.
- 4. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
 - a. Minimum Size: 3.5 by 5 inches.
 - b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
- B. Identification for Conductors and Cables:
 - 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
 - Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
 - 3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 - a. At each source and load connection.
 - b. Within boxes when more than one circuit is present.
 - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
 - 4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
- C. Identification for Raceways:
 - 1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
 - 2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
 - 3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
 - 4. Use underground warning tape to identify underground raceways.
- D. Identification for Boxes:
 - 1. Use voltage markers to identify highest voltage present.
 - 2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
 - a. For exposed boxes in public areas, use only identification labels.
- E. Identification for Devices:

- 1. Wiring Device and Wallplate Finishes: Comply with Section 262726.
- 2. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
 - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
- 3. Use identification label or engraved wallplate to identify load controlled for wallmounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
- F. Identification for Luminaires:
 - 1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 - 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 - 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically nonconductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
 - 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laseretched text.
 - 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 - 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
 - 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
 - 1. Minimum Size: 1 inch by 2.5 inches.
 - 2. Legend:
 - a. Equipment designation or other approved description.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height:
 - a. Equipment Designation: 1/2 inch.
 - b. Other Information: 1/4 inch.
 - 5. Color:

- a. Normal Power System: White text on black background.
- D. Format for Caution and Warning Messages:
 - 1. Minimum Size: 2 inches by 4 inches.
 - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 1/2 inch.
 - 5. Color: Black text on yellow background unless otherwise indicated.
- E. Format for Receptacle Identification:
 - 1. Minimum Size: 3/8 inch by 1.5 inches.
 - 2. Legend: Power source and circuit number or other designation indicated.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 3/16 inch.
 - 5. Color: Black text on clear background.
- F. Format for Control Device Identification:
 - 1. Minimum Size: 3/8 inch by 1.5 inches.
 - 2. Legend: Load controlled or other designation indicated.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 3/16 inch.
 - 5. Color: Black text on clear background.

2.03 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch.
- F. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

- A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.
- B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- C. Minimum Size:
 - 1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
 - 2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.

- 3. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- D. Legend:
 - 1. Markers for Voltage Identification: Highest voltage present.
- E. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4-mil.
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:

2.06 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 - 1. Materials:
 - 2. Minimum Size: 7 by 10 inches unless otherwise indicated.
- C. Warning Labels:
 - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or selfadhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 - 3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 - 1. Surface-Mounted Equipment: Enclosure front.
 - 2. Flush-Mounted Equipment: Inside of equipment door.
 - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 - 4. Elevated Equipment: Legible from the floor or working platform.
 - 5. Branch Devices: Adjacent to device.
 - 6. Interior Components: Legible from the point of access.
 - 7. Conduits: Legible from the floor.
 - 8. Boxes: Outside face of cover.
 - 9. Conductors and Cables: Legible from the point of access.
 - 10. Devices: Outside face of cover.

- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Mark all handwritten text, where permitted, to be neat and legible.

3.02 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 08 02

INSTALLATION & ACCEPTANCE TESTING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 INTRODUCTION

TITLE 24 REQUIRES THE COMPLETION OF ALL APPLICABLE CERTIFICATES OF INSTALLATION AND CERTIFICATES OF ACCEPTANCE FOR LIGHTING SYSTEMS. THIS SHALL INCLUDE INDOOR AND OUTDOOR LIGHTING SYSTEMS.

1.02 <u>GENERAL REQUIREMENTS</u>

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.03 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to: Complete all Title 24 required Certificate(s) of Installation (NRCI) and Certificate(s) of Acceptance (NRCA) to be completed per the contract documents.

1.04 RESPONSIBILITIES OF INSTALLING CONTRACTORS

A. General Contractor (GC)

Ensure that all contractors identified as the contractor responsible for acceptance testing and completion of the Title 24 Certificate(s) of Acceptance are certified by the State of California or its designated body to conduct each respective test.

- B. Electrical Contractor (EC)
 - 1. Verify proper installation and performance of all electrical services provided.
 - 2. Meet with acceptance tester at beginning of construction to review project requirements.
 - 3. Complete Title 24 Certificate(s) of Installation and manufacturer's pre-start checklists prior to scheduling startup/programming of lighting control equipment.
 - a. Retain Certificate(s) of Installation in a 3-ring binder in an organized fashion. Binder is to remain on the job site
 - b. Make Certificate(s) of Installation available for building inspector's review.
 - c. Retain calibration records for equipment provided with manufacturer calibrated sensors in the Certificate(s) of Installation binder.
 - d. Correct labeling of all circuits with connected equipment.
 - 4. Complete the Certificate(s) of Acceptance per the contract documents.
 - a. The company installing the lighting systems must be an authorized Lighting Controls Acceptance Test Employer certified by a Lighting Controls Acceptance Test Technician Certification Provider or include in their bid the cost of retaining and overseeing a contractor who is an authorized Lighting Controls Acceptance Test Employer to complete the acceptance testing.
 - b. All required acceptance testing must be completed by a Lighting Controls Acceptance Test Technician employed by the Lighting Controls Acceptance

Test Employer. The acceptance tester shall be present for all commissioning efforts.

- c. Retain Certificate(s) of Acceptance in a 3-ring binder in an organized fashion. Binder is to remain on the job site
- d. Upload all Certificate(s) of Acceptance to the California Title 24 Certificates of Acceptance database, if, at the time of project completion, the database is available to the public.
- 5. Successful completion of the required Acceptance Tests is the responsibility of the installing contractor. Any costs associated with modifications necessary to obtain compliance and re-testing of systems shall be included in the base bid of this project.

1.05 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.06 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.07 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.08 SUBMITTALS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- B. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.

1.09 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.10 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.11 EXTRA MATERIALS

Not required.

1.12 <u>RECORD DRAWINGS</u>

Provide in accordance with:

A. Project Manual Volume One, Sections 00710, Article 6.12 – Record Documents.

- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.13 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

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SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Occupancy sensors.
 - 2. Daylighting controls.
- C. Related requirements:
 - 1. Section 26 05 29 Hangers and Supports for Electrical Systems.
 - 2. Section 26 05 33.16 Boxes for Electrical Systems.
 - 3. Section 26 05 53 Identification for Electrical Systems: Identification products and requirements.
 - 4. Section 26 27 26 Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

1.03 STANDARDS AND REFERENCES

- A. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 130 Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- D. NEMA 410 Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2015.
- E. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 1472 Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 <u>QUALITY ASSURANCE</u>

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Conform to requirements of NFPA 70.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- E. Coordination:

- 1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
- 2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
- 3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
- 4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
- 5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

Occupancy Sensors: Include detailed motion detection coverage range diagrams.

- C. Shop Drawings:
 - 1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
 - 2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.
- D. Field Quality Control Reports.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 OPERATION AND MAINTENANCE DATA

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Article 6.12 Record Documents.
 - 2. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
 - 3. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- B. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- C. Operation and Maintenance Data: Include detailed information on device programming and setup.

1.10 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.11 RECORD DRAWINGS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
 - 2. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
 - 3. Project Manual Volume Four, Section 01 78 39 Project Record Documents.
- B. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Provide five year manufacturer warranty for all occupancy sensors.
- E. Provide five year manufacturer warranty for all daylighting controls.

PART 2 - PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

- A. All Occupancy Sensors:
 - Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
 - 2. Sensor Technology:

- a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
- b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
- c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
- 3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
- 4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
- 5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
- 6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
- 7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
- 8. Sensitivity: Field adjustable.
- 9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
- 10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
- 11. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
- 12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
- B. Wall Switch Occupancy Sensors:
 - 1. All Wall Switch Occupancy Sensors:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
 - b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
 - c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
 - d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - e. Manual-Off Override Control: When used to turn off load while in automaticon mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.

- C. Wall Dimmer Occupancy Sensors:
 - 1. General Requirements:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability, and no leakage current to load in off mode.
 - b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
 - d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
 - e. Finish: Color to be selected.
- D. Ceiling Mounted Occupancy Sensors:
 - 1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 - b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
 - c. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
 - d. Finish: White unless otherwise indicated.
 - 2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:

Standard Range Sensors: Capable of detecting motion within an area of 1000 at a mounting height of 9 feet, with a field of view of 360 degrees.

- E. Power Packs for Low Voltage Occupancy Sensors:
 - 1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
 - 2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
 - 3. Input Supply Voltage: Dual rated for 120/277 V ac.
 - 4. Load Rating: As required to control the load indicated on drawings.

2.03 DAYLIGHTING CONTROLS

System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of lighting control devices provided under this section.
 - 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
 - 2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
 - 3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.
- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.
- G. Provide required supports in accordance with Section 260529.
- H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- I. Identify lighting control devices in accordance with Section 260553.
- J. Occupancy Sensor Locations:

- 1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
- 2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- K. Daylighting Control Photo Sensor Locations:
 - 1. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
 - 2. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.
- L. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
- M. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.
- N. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.
- O. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.04 FIELD QUALITY CONTROL

- A. Inspect each lighting control device for damage and defects.
- B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- C. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
- D. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.
- C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- D. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.06 <u>CLEANING</u>

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
 - 3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
 - 4. Location: At project site.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
 - 2. Overcurrent protective devices for switchboards.
- C. Related requirements:
 - 1. Section 260526 Grounding and Bonding for Electrical Systems.
 - 2. Section 260529 Hangers and Supports for Electrical Systems.

1.03 STANDARDS AND REFERENCES

- A. FS W-C-375 Circuit Breakers, Molded Case; Branch Circuit and Service; Revision E with Supplement 1, 2013.
- B. IEEE C57.13 IEEE Standard Requirements for Instrument Transformers; 2016.
- C. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- D. NECA 400 Standard for Installing and Maintaining Switchboards; 2007.
- E. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- F. NEMA PB 2 Deadfront Distribution Switchboards; 2011.
- G. NEMA PB 2.1 General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; 2013.
- H. NETA ATS Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- I. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- K. UL 869A Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- L. UL 891 Switchboards; Current Edition, Including All Revisions.
- M. UL 1053 Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.
- 1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Conform to requirements of NFPA 70.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- D. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- E. Service Entrance Switchboards:
 - 1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
 - 2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
 - 3. Obtain Utility Company approval of switchboard prior to fabrication.
 - 4. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
- D. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
- E. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- F. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

Maintain field conditions within required service conditions during and after installation.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.10 EXTRA MATERIALS

- A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.
- B. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project: Enclosure Keys: Two of each different key.

1.11 <u>RECORD DRAWINGS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
 - 2. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
 - 3. Project Manual Volume Four, Section 01 78 39 Project Record Documents.
- B. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

1.12 WARRANTY

Provide in accordance with:

A. Project Manual Volume One, Sections 00710, Article 6.12 – Contractor's General Warranty and Guarantee.

- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Switchboards Basis of Design: Eaton.
- B. Switchboards Other Acceptable Manufacturers:
 - 1. Eaton Corporation; _____: www.eaton.com/#sle.
 - 2. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
 - 3. Siemens Industry, Inc: www.usa.siemens.com/#sle.
- C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- D. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 SWITCHBOARDS

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Service Entrance Switchboards:
 - 1. Listed and labeled as suitable for use as service equipment according to UL 869A.
 - 2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
 - 3. Comply with Utility Company requirements for electrical service.
 - 4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
- E. Service Conditions:
 - 1. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- F. Short Circuit Current Rating:
 - 1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
 - 2. Listed series ratings are not acceptable.

- G. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- H. Bussing: Sized in accordance with UL 891 temperature rise requirements.
 - 1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
 - 2. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 - 3. Phase and Neutral Bus Material: Copper.
 - 4. Ground Bus Material: Copper.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
 - 1. Line Conductor Terminations:
 - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Main and Neutral Lug Type: Mechanical.
 - 2. Load Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Lug Type:
 - 1) Provide mechanical lugs.
- J. Enclosures:
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
 - b. Outdoor Locations: Type 3R.
 - 2. Finish: Manufacturer's standard unless otherwise indicated.
 - 3. Outdoor Enclosures:
 - a. Color: Manufacturer's standard.
 - b. Access Doors: Lockable, with all locks keyed alike.
- K. Future Provisions:
 - 1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
 - 2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.
 - 3. Where designated spaces for future device provisions are not indicated, include provisions for minimum of 6 device(s) rated at 25 percent of rating of switchboard main or incoming feed.
 - 4. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections where indicated.
- L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

- 1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
- 2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
 - a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
 - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
- M. Instrument Transformers:
 - 1. Comply with IEEE C57.13.
 - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 - 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit Breakers:
 - 1. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 2. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, tripindicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 1) Provide thermal magnetic circuit breakers unless otherwise indicated.
 - b. Minimum Interrupting Capacity:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - 2) 14,000 rms symmetrical amperes at 480 VAC.
 - c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - d. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2.04 SOURCE QUALITY CONTROL

- A. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
 - 1. Dielectric tests.

- 2. Mechanical operation tests.
- 3. Grounding of instrument transformer cases test.
- 4. Electrical operation and control wiring tests, including polarity and sequence tests.
- 5. Ground-fault sensing equipment test.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive switchboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install switchboards plumb and level.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Install all field-installed devices, components, and accessories.
- I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- J. Set field-adjustable circuit breaker tripping function settings as directed.
- K. Set field-adjustable ground fault protection pickup and time delay settings as directed.
- L. Provide filler plates to cover unused spaces in switchboards.

3.03 FIELD QUALITY CONTROL

- A. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.1.
- D. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than ______ amperes. Tests listed as optional are not required.
- E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

- 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulationresistance test on control wiring listed as optional is not required.
- F. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
- G. Test shunt trips to verify proper operation.
- H. Correct deficiencies and replace damaged or defective switchboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of switchboard covers and doors.

3.05 <u>CLEANING</u>

- A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred surfaces to match original factory finish.

3.06 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Power distribution panelboards.
 - 2. Lighting and appliance panelboards.
 - 3. Overcurrent protective devices for panelboards.
- C. Related requirements:
 - 1. Section 260526 Grounding and Bonding for Electrical Systems.
 - 2. Section 260529 Hangers and Supports for Electrical Systems.

1.03 STANDARDS AND REFERENCES

- A. FS W-C-375 Circuit Breakers, Molded Case; Branch Circuit and Service; Revision E with Supplement 1, 2013.
- B. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA 407 Standard for Installing and Maintaining Panelboards; 2015.
- D. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- E. NEMA PB 1 Panelboards; 2011.
- F. NEMA PB 1.1 General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
- G. NETA ATS Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- H. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 50E Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 67 Panelboards; Current Edition, Including All Revisions.
- L. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with other trades to provide walls suitable for installation of flushmounted panelboards where indicated.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- C. Conform to requirements of NFPA 70.
- D. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

- C. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

- A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.
- B. Maintenance Data:
 - 1. Include information on replacement parts and recommended maintenance procedures and intervals.
 - 2. Maintenance Materials:
 - 3. Furnish the following for Owner's use in maintenance of project: Panelboard Keys: Two of each different key.

1.10 RECORD DRAWINGS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
 - 2. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
 - 3. Project Manual Volume Four, Section 01 78 39 Project Record Documents.
- B. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

- 2.01 <u>MANUFACTURERS</u>
 - A. Eaton Corporation: www.eaton.com.
 - B. Schneider Electric; Square D Products: www.schneider-electric.us.
 - C. Siemens Industry, Inc: www.usa.siemens.com.

- D. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.
- 2.02 PANELBOARDS GENERAL REQUIREMENTS
 - A. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature: Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
 - C. Short Circuit Current Rating:

Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- J. Load centers are not acceptable.
- 2.03 POWER DISTRIBUTION PANELBOARDS
 - A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase and Neutral Bus Material: Copper.
 - 2. Ground Bus Material: Copper.
- D. Circuit Breakers:
 - 1. Provide bolt-on type.
 - 2. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 225 amperes.
 - 3. Provide electronic trip circuit breakers for circuit breaker frame sizes 225 amperes and above.
- E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 - 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Copper.
 - 3. Ground Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 - 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

- 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
- 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - 2) 14,000 rms symmetrical amperes at 480 VAC.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
- 3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
- 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
- 5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
- 6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
- 7. Do not use tandem circuit breakers.
- 8. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 260526.
- K. Install all field-installed branch devices, components, and accessories.
- L. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- M. Provide filler plates to cover unused spaces in panelboards.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.
- C. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- 3.05 <u>CLEANING</u>
 - A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
 - B. Repair scratched or marred exterior surfaces to match original factory finish.

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SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Wall switches.
 - 2. Receptacles.
 - 3. Wall plates.
- C. Related requirements:
 - 1. Section 260533.16 Boxes for Electrical Systems.
 - 2. Section 260553 Identification for Electrical Systems: Identification products and requirements.

1.03 STANDARDS AND REFERENCES

- A. FS W-C-596 Connector, Electrical, Power, General Specification for; Revision H, 2014.
- B. FS W-S-896 Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Revision G, 2014.
- C. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- D. NECA 130 Standard for Installing and Maintaining Wiring Devices; 2010.
- E. NEMA WD 1 General Color Requirements for Wiring Devices; 1999 (R2015).
- F. NEMA WD 6 Wiring Devices Dimensional Specifications; 2016.
- G. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 General-Use Snap Switches; Current Edition, Including All Revisions.
- I. UL 498 Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- J. UL 514D Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- K. UL 943 Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

- C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- D. Coordination:
- 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
- 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
- 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
- 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
- 5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- E. Sequencing: Do not install wiring devices until final surface finishes and painting are complete.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- 1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 <u>RECORD DRAWINGS</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Hubbell Incorporated: www.hubbell-wiring.com.
- B. Leviton Manufacturing Company, Inc: www.leviton.com.
- C. Lutron Electronics Company, Inc: www.lutron.com.
- D. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

2.02 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Provide GFCI protection for receptacles serving electric drinking fountains.
- G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.03 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.
- C. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.
- D. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
- E. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.
- 2.04 WALL SWITCHES
 - A. Wall Switches General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as

complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.

- 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.05 <u>RECEPTACLES</u>

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell-wiring.com.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com.
 - 3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
 - 4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
- B. Receptacles General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
- D. GFCI Receptacles:
 - 1. GFCI Receptacles General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 - Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.06 WALL PLATES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell-wiring.com.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com.
 - 3. Lutron Electronics Company, Inc: www.lutron.com.
 - 4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
- B. Wall Plates: Comply with UL 514D.

- 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
- 2. Size: Standard.
- 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
 - 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 48 inches above finished floor.
 - b. Receptacles: 18 inches above finished floor or 6 inches above counter.
 - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 - 4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
 - 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
- J. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- K. Install wall switches with OFF position down.
- L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- O. Identify wiring devices in accordance with Section 260553.

3.04 FIELD QUALITY CONTROL

- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch with circuit energized to verify proper operation.
- C. Test each receptacle to verify operation and proper polarity.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to: Fuses.

1.03 STANDARDS AND REFERENCES

- A. NEMA FU 1 Low Voltage Cartridge Fuses; 2012.
- B. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 Low-Voltage Fuses Part 1: General Requirements; Current Edition, Including All Revisions.
- D. UL 248-12 Low-Voltage Fuses Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- D. Coordination:
 - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
 - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

A. Provide in accordance with:

- 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
- 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 <u>MANUFACTURERS</u>

- A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com.
- B. Littelfuse, Inc: www.littelfuse.com.
- C. Mersen: ep-us.mersen.com.

2.02 APPLICATIONS

A. Individual Motor Branch Circuits: Class RK1, time-delay.

2.03 <u>FUSES</u>

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.

PART 3 - EXECUTION

- 3.01 EXAMINATION
 - A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
 - B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

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SECTION 26 28 16.16

ENCLOSED SWITCHES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to: Enclosed safety switches.
- C. Related requirements:
 - 1. Section 260526 Grounding and Bonding for Electrical Systems.
 - 2. Section 260529 Hangers and Supports for Electrical Systems.
 - 3. Section 262813 Fuses.

1.03 STANDARDS AND REFERENCES

- A. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- B. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- C. NEMA KS 1 Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- D. NETA ATS Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- E. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 50E Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 98 Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- D. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.

- 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
- 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
- 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
- D. Project Record Documents: Record actual locations of enclosed switches.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 <u>WARRANTY</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation: www.eaton.com.
- B. Schneider Electric; Square D Products: www.schneider-electric.us.
- C. Siemens Industry, Inc: www.usa.siemens.com.
- D. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
 - 2. Minimum Ratings:

Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

- 1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
- L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- M. Heavy Duty Switches:
 - 1. Comply with NEMA KS 1.
 - 2. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 <u>ADJUSTING</u>

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 <u>CLEANING</u>

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

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SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to:
 - 1. Interior luminaires.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Ballasts and drivers.

1.03 STANDARDS AND REFERENCES

- A. IES LM-63 IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- B. IESNA LM-63 ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- C. IES LM-79 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.
- D. IES LM-80 Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; 2015.
- E. NECA/IESNA 500 Standard for Installing Indoor Commercial Lighting Systems; 2006.
- F. NECA/IESNA 502 Standard for Installing Industrial Lighting Systems; 2006.
- G. NEMA LE 4 Recessed Luminaires, Ceiling Compatibility; 2012.
- H. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 101 Life Safety Code; 2015.
- J. UL 924 Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- K. UL 1598 Luminaires; Current Edition, Including All Revisions.
- L. UL 8750 Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

- C. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
 - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- A. Shop Drawings:
 - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 - 2. Provide photometric calculations where luminaires are proposed for substitution upon request.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
 - 1. LED Luminaires: Include estimated useful life, calculated based on IES LM-80 test data.
 - Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
 - 3. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
 - 4. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
- C. Samples: Provide one sample(s) of each luminaire proposed for substitution upon request.
- D. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- D. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 OPERATION AND MAINTENANCE DATA

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Article 6.12 Record Documents.
 - 2. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
 - 3. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- B. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.10 EXTRA MATERIALS

- A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.
- B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
 - 2. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
 - 3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.

1.11 RECORD DRAWINGS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
 - 2. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
 - 3. Project Manual Volume Four, Section 01 78 39 Project Record Documents.
- B. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.12 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.

- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.
- D. Provide five year manufacturer warranty for all LED luminaires, including drivers.
- E. Provide five year pro-rata warranty for batteries for emergency lighting units.

PART 2 - PRODUCTS

2.01 <u>LUMINAIRE TYPES</u>

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 <u>LUMINAIRES</u>

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
- H. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
 - 1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.04 EXIT SIGNS

- A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
 - 1. Number of Faces: Single or double as indicated or as required for the installed location.
 - 2. Directional Arrows: As indicated or as required for the installed location.

2.05 BALLASTS AND DRIVERS

- A. Ballasts/Drivers General Requirements:
 - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
 - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- B. Dimmable LED Drivers:
 - 1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
 - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.
- 3.03 INSTALLATION
 - A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
 - B. Install products in accordance with manufacturer's instructions.
 - C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
 - D. Provide required support and attachment in accordance with Section 260529.
 - E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
 - F. Suspended Ceiling Mounted Luminaires:
 - 1. Do not use ceiling tiles to bear weight of luminaires.

- 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
- 3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
- 4. Secure pendant-mounted luminaires to building structure.
- 5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
- 6. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- G. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
 - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
 - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- H. Suspended Luminaires:
 - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 - 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
 - 4. Install canopies tight to mounting surface.
- I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Emergency Lighting Units:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- M. Exit Signs:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- N. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.
- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.
- B. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

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SECTION 26 51 20

AUTOMATIC LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Provide and design an automatic lighting control system, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.

1.03 STANDARDS AND REFERENCES

- A. UL 916 Energy Management Equipment.
- B. FCC Emissions Standards specified in Part 15, subpart J for Class A, Applications.

1.04 QUALITY ASSURANCE

- A. Manufacturer shall have a minimum of 10 years' experience in manufacturing and installing this type of system.
- B. The Contractor shall provide a list of recent jobs completed during the last 5 years with the name and phone number of a contact person.
- C. All components and assemblies are to be pre-tested and assembled at the factory prior to installation.
- D. Provide a factory-trained technician on site. The technician shall functionally test each component in the system after installation to verify proper operation and confirm that the panel wiring and addressing conform to the wiring documentation.

1.05 <u>SUBSTITUTIONS</u>

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and Samples.
- B. The following list includes the required shop drawings and product data information that shall be submitted.
 - 1. Underwriters Laboratories, Inc. (UL) listing and factory test reports.
 - 2. Internal and system wiring diagrams.
 - 3. Single line diagram of the system configuration. Typical riser diagrams are not acceptable.

- 4. Dimensions of the equipment layout.
- 5. Control wiring and conduits layout and connections.
- 6. Floor plans to scale showing the location of each device and equipment.
- 7. Product data of all the components including but not limited to programmable central controllers, transceivers panels, input relays, switches and other ancillary equipment.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

A. Provide Materials in accordance with Project Manual Volume Four, Section 01 78 00.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide and microprocessor controlled relay panels for the Lighting Control System. The system shall include programmable standalone master panel, switch inputs, wiring, power supplies, relays and ancillary relays.
- B. Panels shall be capable of standing alone or operating as part of a network.
 - 1. The system shall provide intelligence to operate as follows:
 - a. Store all user operating data.

- b. Initiate all relay output commands based on:
 - 1) Operator inputs
 - 2) Automatic operating schedule
 - 3) Binary type field sensors
 - 4) Universal override switch inputs
 - 5) Internal 56K Baud modem
- c. Provide automatic system diagnostics and alarming based on detected faults in the controller, transceiver panels, relays, and data line.
- 2. System shall include a memory back up to be able to survive an indefinite length of power failure.
- C. Lighting Control Panel (LCP): Microprocessor based, complete prewired assemblies consisting of the following:
 - Stand-alone panel controller capable of receiving and acting upon programs downloaded from the central computer. Programs downloaded from the network shall be capable of continuing to operate even if the network should fail. Battery Backup provides 8 days of memory retention. Panel shall be part of a system that can control up to 750 relays and receive up to 500 switch inputs. Panel shall have an USB input for local programming and trouble shooting from a laptop computer.
 - 2. Internal digital clock with self-control power.
 - 3. Output modules: Plug in type to receive coded digital commands from the panel controller and pulse output relays to the appropriate state. Actual status feedback of the relays are to be fed back to the panel controller and from there to the central computer. Actual status of each relay is to be indicated by a pilot LED on the control board. Each Module controls 8 or 16 relays.
 - 4. Switch input modules: Plug-in type, actuated by remote external contact closures. These contact closures may be either momentary or maintained. The action of the contact is noted by the panel controller and acted upon as programmed by software. The action of the contact can command any group of output relays to the desired state. Either 8 or 24-input channels as shown on the plans.
 - 5. Output Relays
 - a. Type: Momentary pulsed, mechanically latched with pilot light contact.
 - b. Rating: 20 Ampere, 277VAC
 - c. Number per panel: 16, 32 or 48 as required to satisfy this project scope.
 - 6. The low voltage and high voltage sections of the lighting control cabinet shall be separated by a 14 gage steel barrier in which the relays are mounted. In areas where both 120 volt and 277 volt loads are present the high voltage compartment shall have a 14 gage steel barrier between the relays that carry 120 VAC and the relays that carry 277VAC. Each section shall be clearly labeled as to the voltage in that compartment.
 - Panel power supply shall be dual primary 115/277 volts AC, 60 Hz. ± 10%. Low voltage side shall be protected from power line surges and spikes on the input power. The low voltage section shall be protected against short circuit faults and relay failures.
 - 8. Panels shall be UL approved and shall have a short circuit withstand current rating at 14,000 AIC.

9. Manufacturer: Lighting Control and Design, or G.E. or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The Lighting Control System shall be installed and wired completely as required by the equipment manufacturer by the contractor, who shall make all necessary wiring connections to the lighting fixtures, override switches, photo cells and equipment.
- B. The Contractor shall provide on-site programming time with factory-trained personnel for the system set-up. The Contractor shall set up the software program and program the entire system in accordance with the Owner's instructions.
- C. Documentation
 - Accurate "as-built" drawings shall be provided by the Contractor. These shall indicate the load controlled by each relay and the identification number for that switch connected to an input and the identification number of that input. Three sets of space plans or reflected ceiling plans shall be provided by the contractor indicating which fixtures are controlled by each relay.
 - 2. A separate data grade private line with RJ45 jack shall be furnished for each modem.

3.02 SERVICE AND SUPPORT

- A. Startup: After the system has been installed, the Contractor shall provide the services of a factory trained representative of the manufacturer to verify correct operation of all system components. The contractor shall guarantee all material and workmanship involving the system for three years after startup.
- B. Training: After system startup and after all the programming is completed, the Contractor shall arrange for a factory trained representative to train the Owner's personnel. The trainer shall instruct the Owner's personnel in how to program the system and demonstrate a typical operating program for an area. The Contractor shall allow for 24 hours' instruction time for the Owner's training.
- C. Factory Support: Factory support shall be available free of charge during the three-year warranty period to answer programming and application questions. The manufacturer, or his representative, shall have a remote terminal capable of programming the system to support the Owner's personnel during this period. The Contractor shall include a modem, necessary cabling and telephone extension to support this telecommunications operation. The Contractor shall provide a three-year maintenance service contract as part of the cost.
- D. The Contractor shall also provide a software site licensing so that the Owner will be able to transfer the software program from the main computer to the other computers. This transfer shall not be an extra cost to the Owner.

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

- A. Supply and install all items, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
- B. Section includes, but is not limited to: Exterior luminaires.

1.03 STANDARDS AND REFERENCES

- A. IES LM-79 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.
- B. IES LM-80 Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; 2015.
- C. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- D. NECA/IESNA 501 Standard for Installing Exterior Lighting Systems; 2006.
- E. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 1598 Luminaires; Current Edition, Including All Revisions.
- G. UL 8750 Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Sections 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Sections 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 <u>SUBMITTALS</u>

- A. Provide in accordance with:
 - 1. Project Manual Volume One, Sections 00710, Article 6.17 Shop Drawings and Samples.
 - 2. Project Manual Volume One, Sections 00800, SC-6.17 Shop Drawings and

Samples.

- B. Shop Drawings:
 - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 - 2. Provide photometric calculations where luminaires are proposed for substitution upon request.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

LED Luminaires: Include estimated useful life, calculated based on IES LM-80 test data.

D. Samples: Provide one sample(s) of each luminaire proposed for substitution upon request.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Project Manual Volume One, Sections 00710, Article 6.03 Services, Materials and Equipment.
- B. Provide in accordance with Project Manual Volume One, Sections 00800, SC-6.03.B Services, Materials and Equipment.
- C. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- D. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents
- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.

1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A Record Documents.
- C. Project Manual Volume Four, Section 01 78 39 Project Record Documents.

1.11 WARRANTY

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

D. Provide five year manufacturer warranty for all LED luminaires, including drivers.

PART 2 - PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.
- 3.03 INSTALLATION
 - A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
 - B. Install products in accordance with manufacturer's instructions.
 - C. Install luminaires in accordance with NECA/IESNA 501.

- D. Provide required support and attachment in accordance with Section 260529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Install accessories furnished with each luminaire.
- G. Bond products and metal accessories to branch circuit equipment grounding conductor.
- H. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.06 <u>CLEANING</u>

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.
- B. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

SECTION 32 33 00

SITE FURNISHINGS

PART 1 – GENERAL

1.01 <u>GENERAL REQUIREMENTS</u>

The following General Requirements apply to this Section:

- A. Project Manual Volume 1 of 4, Contract Documents.
- B. Project Manual Volume 2 of 4, Special Conditions.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Site Furnishings, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

- A. Comply with the Standard requirements established by Manufacturer.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per:

- A. Project Manual Volume One, Section 00710, Article 6.05 Substitutes and "Or-Equals".
- B. Project Manual Volume One, Section 00800, SC-6.05 Substitutes and "Or-Equals".

1.06 SUBMITTALS

- A. Provide in accordance with Project Manual Volume One, Section 00710, Article 6.17 Shop Drawings and Samples.
- B. Provide in accordance with Project Manual Volume One, Section 00800, SC-6.17 Shop Drawings and Samples.
- C. Cut sheets and product data of items proposed to be provided.
- D. Erection procedures, sequence of erection, and required handling equipment.

1.07 DELIVERY, STORAGE, AND HANDLING

Provide in accordance with:

- A. Project Manual Volume One, Section 00710, Article 6.03 Services, Materials and Equipment.
- B. Project Manual Volume One, Section 00800, SC-6.03.B Services, Materials and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

Provide in accordance with:

- A. Project Manual Volume One, Article 6.12 Record Documents.
- B. Project Manual Volume One, Sections 00800, SC-6.12.A. Record Documents

- C. Project Manual Volume Four, Section 01 78 23 Operation and Maintenance Data.
- 1.09 EXTRA MATERIALS

Not required.

1.10 RECORD DRAWINGS

Not required.

1.11 <u>WARRANTY</u>

Provide in accordance with:

- A. Project Manual Volume One, Sections 00710, Article 6.12 Contractor's General Warranty and Guarantee.
- B. Project Manual Volume One, Sections 00800, SC-6.19.C. Contractor's General Warranty and Guarantee.
- C. Provide Manufacturer's Standard Warranty in accordance with Section 01 77 00.

PART 2 – PRODUCTS

2.01. TRASH AND RECYCLE RECEPTACLES

- A. Basis of Design: Superior Recreational Products, Carrollton, GA 30117. Website: www.webcoat.com
- B. Or Architect approved equal.
- C. Models as indicated in the Drawings.
- D. Finish as selected by Architect from manufacturer's standard finishes and colors.

PART 3 – EXECUTION

- 3.01 EXAMINATION
 - A. Examine the areas and conditions under which work of this Section will be performed.
 - B. Notify the Construction Manager and Architect in writing of any conditions detrimental to the proper and timely completion of the installation.
 - C. Correct conditions detrimental to timely and proper complete of the Work.
 - D. Do not proceed until unsatisfactory conditions are corrected.
 - E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

Confirm locations with Owner and Architect in field.

- 3.02 INSTALLATION
 - A. Install items per manufacturer's recommendations.
 - B. All items to be secured in place to limit vandalism.
- 3.03 <u>CLEAN-UP</u>

Wipe clean all surfaces and protect from work of other trades.